CUSTOMIZE YOUR ARF AND WIN!

NEW ELECTRIC HELI
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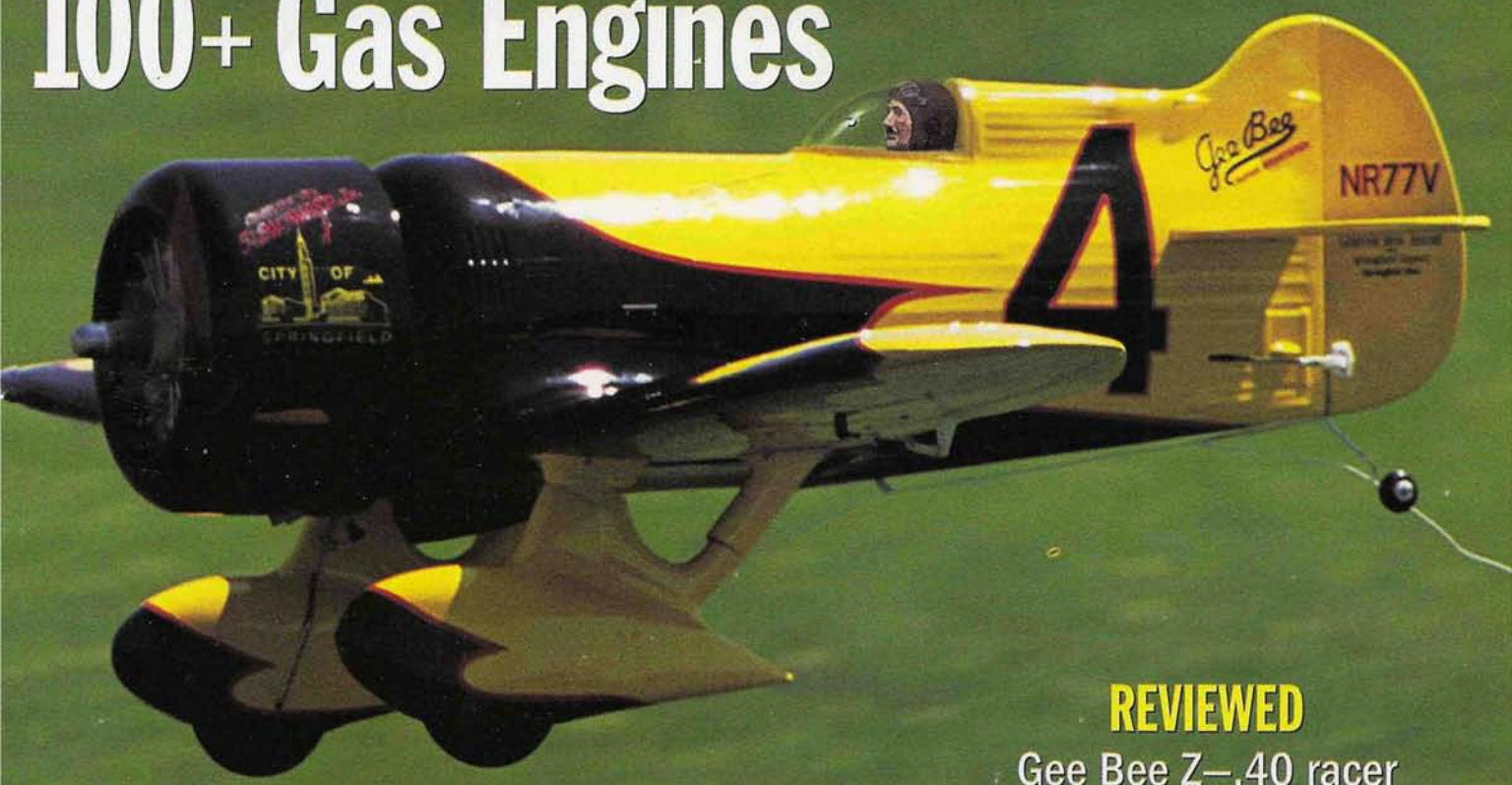
MODEL Airplane NEWS

RAW POWER!

100+ Gas Engines



REVIEWED

Gee Bee Z—.40 racer

Tiger Moth—classic ARF

Chipmunk—scale showplane

Staudacher—.60 aerobat

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MODEL Airplane NEWS

MAY 2002 VOLUME 130, NUMBER 5

ON THE COVER: the Kyosho Gee Bee Z lands after another successful circuit. This .40-size ARF model is easy to assemble and has great flight performance; see Rick Bell's review on page 42 (photo by Walter Sidas).

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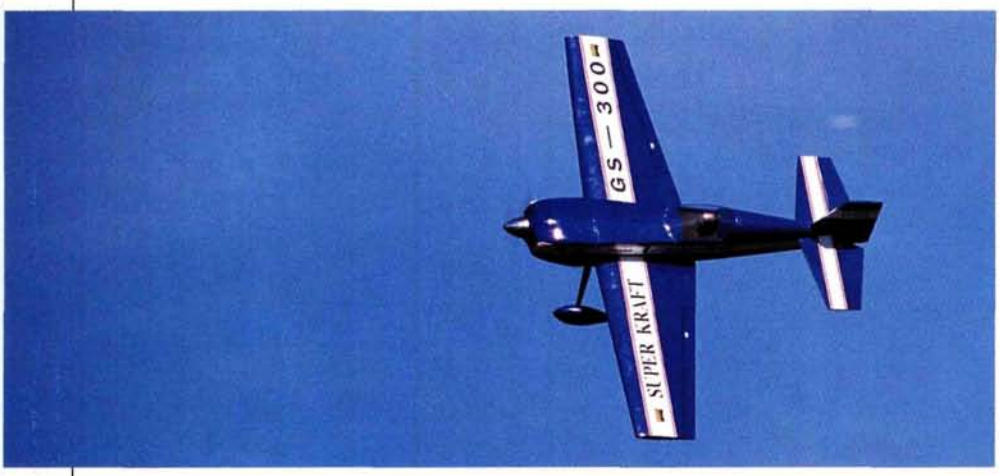
EDITORIAL

BY DEBRA SHARP

Step up to big power

Big airplanes need big power, and gas-fueled engines are a great choice for your giant-scale plane. They're reliable, easy and inexpensive to run, they can turn big props slowly for high thrust efficiency, and they consume ⅓ the fuel of a glow engine of the same displacement. In senior tech editor Gerry Yarrish's "Gas Engine Guide," we highlight 105 powerplants and give tips for mixing fuel and working with spark plugs and pumper carburetors. For everything you want to know about gas engines and more, see page 26.



IN THE WORKSHOP

The new brushless motors from Jeti—the latest in electric-motor technology—are lighter and less expensive than their predecessors. See Bernard Cawley's review of these motors and the speed controls that work with them on page 82. Thinking about installing retractable landing gear in your latest model? Associate editor Rick Bell offers step-by-step, photo-illustrated instructions on page 76; it's easier than you might think!

CHRIS CHIANELLI GOES TO HOLLYWOOD

It came as no surprise to us that Chris Chianelli is a natural in front of the camera—after all, he has basked in the limelight here for years! We will miss him at the Air Age offices and wish him all the best as he pursues a cable-TV career and other RC endeavors.

REDESIGN CONTEST

Do you like almost-ready-to-fly (ARF) models but not their cookie-cutter looks? Customize your ARF and then enter our "Great RC Redesign Contest" and win some cash! We're looking for major and minor mods to sport and scale ARFs—almost anything goes! See how to enter on page 64.

MODEL Airplane NEWS
FOUNDED 1929

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PURSUIT OF A PREDATOR

You guys are amazing! For a while now, I have been interested in the military's remotely piloted UAVs, and I have wanted to build a model of one for a long time. The Predator was high on my "must build" list, so I searched the Internet for information and photos. I could only find bits and pieces of information on the Predator, and I never did find any good scale drawings to use as documentation.

When your March 2002 issue came out, I almost hit the floor! There, in one article, was all the information I could ever have hoped for and, as a bonus, its author Gerry Yarrish supplied an excellent 3-view scale drawing! I was in scratch-builder heaven! Where did you guys get those great close-up pictures?

From a soon-to-be RC UAV pilot, thanks for being such a great source of information. Keep up the good work.

JOSEPH DIVETRO
Kalispell, MO

Joseph, thanks for the words of encouragement. Researching the Predator UAV was as much fun as I have ever had in putting together an article for Model Airplane News. *The first place I contacted was the local U.S. Air Force recruitment office, which supplied public-relations information. From that, I found contact information for the USAF Air Combat Command, which put me in touch with the 11th Reconnaissance Squadron at Nellis AFB, NV. Lt. Carla Pampe, the Public Affairs Action officer for the squadron, supplied most of the photos. Lt. Pampe went to the training grounds at Indian Springs just north of Nellis AFB, and she took up-close-and-personal pictures for my article. The Predator's manufacturer, General Atomics Aeronautical Systems of San Diego, California, also supplied photos.*

I am pleased that you found my article so useful; I, too, think that an RC model Predator—say, with 100-inch wingspan and powered by a .90 to 1.20 4-stroke engine—would make a great model. But would it be a scale warbird? Anyway, thanks again for writing. GY

WHICH ONE TO PICK?

I am looking for a good ¼-scale aerobatic airplane project, and the One Design caught my attention. Are you familiar with it and any manufacturers of a good-quality kit? And how can I get hold of them or any other contacts?

JASON LICKFELT
Hutchinson, MN

Jason: yes, we're very familiar with the DR-107 One Design aerobatic monoplane. It is a very popular full-size homebuilt, and there are a few scale models of it out there. Here's some

info on two we are familiar with, though they aren't ¼ scale. The Troy Built Models almost-ready-to-cover kit designed by Gene Payson is great; the 31-percent model has a 72-inch wingspan and a jig-built wing with foam-rib construction. The fuselage has a balsa-sheeted, hollow-foam turtle deck and stick-built tail feathers. Also included are the aluminum landing gear, a fiberglass engine cowl, a formed-plastic canopy and a tailwheel assembly. Basically, the model comes completely framed up with tail feathers attached and wing panels joined and glassed. Contact Troy Built Models, 2331 Cedar Key Dr., Lake Orion, MI 48360; (248) 391-2331.

For something larger, look at the 38-percent One Design from Eagle Aviation, 4573 Lamme Rd., Dayton, OH 45439; (513) 296-1290. Designed by Frank Noll, this model is available as a ready-to-cover model, a full kit and a semi-kit. It has an 89-inch span, is 80 inches long and is well suited to 3 to 4ci gas engines. A fiberglass engine cowl and wheel pants and a formed canopy are also included.

Good luck in your search for the "right One." GY

SCALE HELICOPTER BODIES

I have been building model planes since I was 10, but I've flown only a handful of them because I've been more interested in building. I've also been a reader of your magazine for most of my adult life; I enjoy the articles and so does my oldest son.

My question is about scale helicopter bodies. I have only been able to find Century Helicopters, which sells outstanding replicas. Could you direct me to other manufacturers of scale bodies? I have been learning to fly my Thunder Tiger Raptor 30 for some time and am hoping to buy a scale body. I would like to build a replica of a full-size aircraft but would like to know whether there are scale bodies out there other than those from Century. [email]

SHANNON McKINNEY
St. Louis, MO

I'm glad to see that you're interested in scale helicopters because I have a lot of fun with the couple I've built. If you plan to use the Raptor 30, beware that there aren't too many bodies out there for 30-size helis. Also, the tail rotor is belt-driven, and that's another consideration to keep in mind. Heli-World [www.heliworld.com; (408) 942-9521] sells the Century brand of bodies and offers the most extensive line of very good-quality aftermarket bodies. For the Raptor, you'll need to custom-fit the mechanics into the body. There are other scale heli bodies out there, but they are for 60-size helis. Most manufacturers offer bodies that fit their own mechanics to make it easier to mate the parts. Vario [www.variousa.com; (805) 553-9996], Robbe [(860) 677-7278] and Miniature Aircraft [www.x-cellrchelicopters.com; (407) 292-4267] are some that come to mind. Heli-World now offers some of its 30-size helis as scale ARF packages; check out its website for more info. Good luck, Shannon! RB

AIR SCOOP

by the Model Airplane News *crew*

COOL NEW PRODUCTS hit the model airplane market all the time, so here's the inside source for what's hot and where you can get it. Every issue, we sift through product announcements, show reports, rumors and prototypes to let you in on the best and the latest. Remember, you saw it here first!

GIANTSCALEPLANES.COM

SWALLOW AND FOCKE WULF

Looking for a new plane or two to spice up the flightline this summer? Either of these new, almost-ready-to-fly (ARF) models from Giantscaleplanes.com should do the trick. The Swallow has a 66-inch wingspan, weighs a little over 8 pounds and is built up of lite-ply. It should be powered by a .60 2-stroke or a .90 4-stroke engine, and it sells for $279.99. The Focke Wulf has a 70-inch wingspan and should be run on a .91 to 1.08 2-stroke or a 1.20 4-stroke engine. It has a built-up fiberglass fuselage, weighs between 9 and 10 pounds and sells for $399.99.

Giantscaleplanes.com, 201 S. 3rd St. & Rt. 309 N., Coopersburg, PA 18036; (610) 282-4811; www.giantscaleplanes.com.

GREAT PLANES

Spirit of St. Louis

This electric-powered, almost-ready-to-fly replica of the Spirit of St. Louis couldn't be more impressive if Lindy himself were at the controls. This 40.1-inch-wingspan model comes almost completely assembled, and its all-foam construction keeps its flying weight down to just over 12 ounces. History buffs and scale enthusiasts alike will love the authentic cowl and replica radial engine. Even the factory-finished fairing material was designed to accent the period landing gear. The best part is that you can park this baby in your hangar for only $99.99.

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826; (800) 637-7660; fax (217) 398-0008; www.greatplanes.com.

JR XP662 6-CHANNEL RADIO

You have to admire a product that is versatile enough to handle two completely different tasks as if it was designed exclusively for each. That's what impresses us most about the JR XP662; it's equally adept at controlling a sport plane or a helicopter. Like its predecessor, the 652, the XP662 includes direct servo control (DSC), dual rates, exponential and programmable mixing. The new model adds easier programming and interface functions that are operated by intuitive rocker switches. It also adds digital trims and a useful throttle-kill button for simple engine shutdown without disturbing the trim settings. The 662 has an additional memory setting (now up to six) and independent trim settings for each heli flight mode. Best of all, these premium functions won't command a premium price; final numbers aren't out yet, but we expect the XP662's price to be competitive with other 6-channel systems.

JR; distributed by Horizon Hobby Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; (877) 504-0233; www.horizonhobby.com.

bbi

COCKPIT & PILOTS

The bbi name is quickly becoming synonymous with precisely made, scale pilot figures, and the tradition continues with the introduction of 1/6-scale F-14 Tomcat pilots. Available in male and female versions, these pilots represent a squadron currently operating from one of the carriers in the Persian Gulf. They're the newest releases from bbi's Freedom Force line of figures that were developed to honor the U.S. Special Forces. Each characteristic of the precisely detailed F-14 pilot, including military equipment and weapons accessories, exactly replicates currently issued equipment. The F-14 Tomcat pilots sell for $39.99.

bbi also has something new on the horizon for you collectors out there. This F-15C Eagle cockpit (below) faithfully replicates the real thing, with features that include a lighted instrument panel, a horizon indicator that moves left or right with the corresponding movement of the flight stick, a removable ejector seat and movable rudder pedals and throttle lever. The ladder and canopy frame are made of die-cast metal, and the entire piece sells for $149. You can't put it in a model, but it would look great on your desk.

bbi; a division of Blue Box Toys, 838 Toy Centre, 200 Fifth Ave., New York, NY 10010; (212) 255-8388; fax (212) 255-8520; bbusa@blueboxtoys.com; www.blueboxtoys.com.

HOBBY LOBBY

KAVAN

Today's lightweight and inexpensive gear can make almost any configuration of park flyer affordable and easy to fly. Check out this delta wing Projeti from Hobby Lobby; it has a 32-inch wingspan and 240 square inches of wing area, and it weighs just 19 to 20 ounces, ready to fly. The stock model is powered by a direct-drive Speed 400 motor and an 8-cell battery, but an optional package with a Speed 480 and a bigger prop (suitable for up to 10 cells) should make this jet

ROJETI

a real screamer. The construction is of all foam, with molded-in recesses for elevon

servos; you supply a 3-channel radio system and an ESC. At just $89, this plane is a great example of a unique, high-quality backyard model available at a very reasonable price.

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; www.hobby-lobby.com.

MAGNUM
1.20 and .46 XLS Engines

Ever since Global discontinued the Magnum 1.20, modelers have been saying how much they miss having this very popular engine size in the Magnum stable. Well, Global was listening, and it now offers an all-new Magnum 1.20 XL to fit between the rails of your favorite Global giant-scale plane. The emphasis of this new design is on reliability and user-friendly operation; big gains have been made in tunability and throttle response. The port dimensions, timing, compression and dome-shaped head are all new. One thing that hasn't changed is the price; you can pick up a Magnum 1.20 XL for $199.99.

While they were at it, the folks at Magnum also gave their popular 40 and 46 XLS engines an update. From intake to exhaust, these engines have been thoroughly reworked for improved power and convenience. The needle settings are much broader and easier to adjust, the idle is smoother, and the transition is crisper than in previous Magnum-series engines. They are more powerful, too; in testing, Magnum squeezed 500 to 600 more rpm out of the new .46 while spinning the same 10x6 prop. Street prices: $69.99 (.40); $89.99 (.46).

Magnum; distributed by Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92708; (714) 963-0133; fax (714) 962-6452; www.globalhobby.com.

WATTAGE

Tubby Cubby and Twin Max

Stability and fun are the watchwords for these two new fun flyers from the folks at WattAge. All you Cub lovers out there who are looking to shake things up a bit should check out the Tubby Cubby. Its foam construction, combined with fiberglass and molded plastic, makes this model both easy to assemble and durable, and the Tubby Cubby's unique design ensures stability. Most important, it comes complete with a Speed 370 motor with matching gearbox and prop, and the remainder of its equipment is completely interchangeable with many other models in its category. The Tubby Cubby has a 37-inch wingspan, weighs between 10 and 11.5 ounces and sells for less than $40.

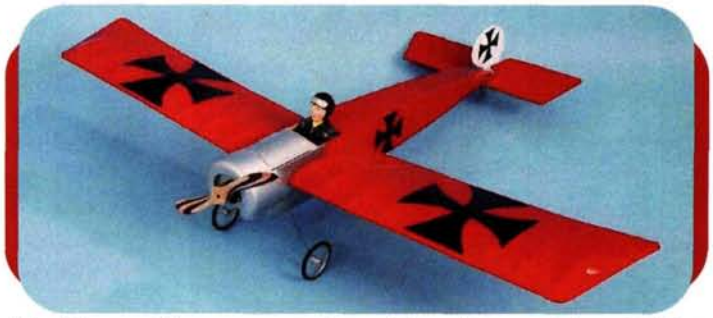
Also from WattAge is this 40-inch-wingspan Twin Max. With its light wing loading and carbon-fiber-reinforced wing, the Twin Max will provide you with nothing but stable, predictable performance. It's easy to build and repair, and its simple foam construction will have you in the air in no time flat. The kit includes two Speed 280 motors with matching gearboxes and props and fiberglass fuselage joiners. It sells for less than $50.

WattAge; distributed by Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92708; (714) 963-0133; fax (714) 962-6452; www.globalhobby.com.

ESPRIT MODEL

Fokker Eindecker

With Esprit's Fokker E III Eindecker, you can re-create classic Great War dogfight action in your very own backyard. The 40-inch-wingspan Fokker is constructed entirely of balsa covered by



Solarfilm, and it comes complete with a 4:1 geared Speed 280, a prop, scale wheels and a scale pilot figure. Weighing only 13 ounces, this Fokker is capable of flying for up to 20 minutes and sells for $90.

Esprit Model, 657 Worcester St., #902, Southbridge, MA 01550; prop.rc@verizon.net; www.espritmodel.com.

WESTON UK

Weston UK has a new .50ci engine—the West V1—to power its lightning-fast Magnum race plane. It's based on an engine from a notable (yet officially anonymous) Austrian engine manufacturer (we can't say which one, but we'll give you a hint: the letter "W" on the side isn't just for Weston). From this excellent starting point, Weston has extensively reworked the West V1; it features an all-new piston and head, recontoured ports, a larger carb and other modifications to emphasize high-rpm breathing. The manufacturing is still being done at the mystery facility, so you know the quality will be topnotch. The new engine has nearly 10 percent more displacement than the Magnum's original powerplant (.50ci versus .46), and Weston's testing has revealed a substantial horsepower gain; on 10-percent nitro fuel, the new engine makes 2.8bhp versus the old engine's 2.2bhp. A key ingredient in the engine's performance is the Weston tuned pipe; it's a mandatory piece with the West V1, but it and the manifold come standard when you buy the engine. The cost for all three is £150 (UK) or about $211 (U.S.).

Weston UK, 84-88 London Rd., Teynham, Sittingbourne, Kent, ME9 9QH, England; enquiries@westonuk.co.uk; www.westonuk.co.uk.

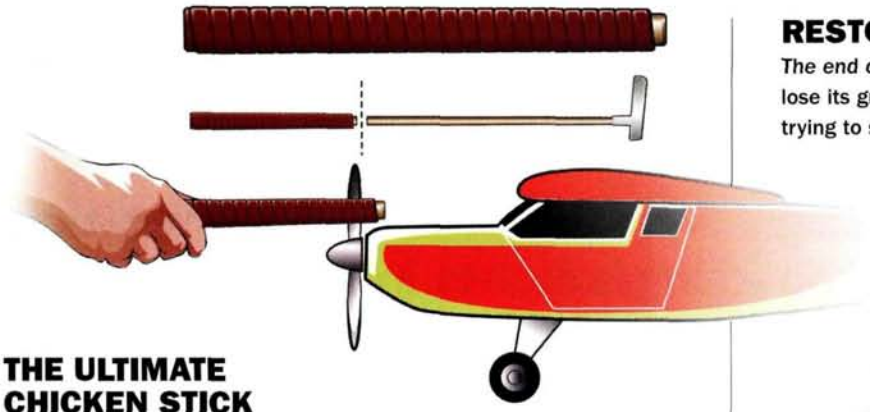
K&B MODEL PRODUCTS

.18 AERO ENGINE

Fliers have a saying: "There's no replacement for displacement." Airplanes need torque to spin their props, and torque (even more than horsepower) is a function of displacement. But increasing displacement means more weight, and weight is the enemy of efficient airplane design. So what is an engine designer to do? K&B's solution is to produce an engine that is the size (and weight) of a common .12 to .15ci engine but with a full .18ci of displacement. The mounts fit most .12 to .15 applications, and the .18 Aero weighs just 6.05 ounces (7.95 ounces with the included muffler). That's at least a 20-percent gain in displacement with no gain in wing loading or added bulk. The operating range is 2,500 to 19,000rpm on 5- to 15-percent-nitro fuel, and the crank is supported by double ball bearings. The street price for this muscular little engine is right around $80, including the standard muffler.

K&B Model Products Inc., 1630 S. California Ave., Monrovia, CA 91016; (626) 359-9527; fax (626) 301-0298; www.modelengine.com.

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News,* 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, or return unused material.



THE ULTIMATE CHICKEN STICK

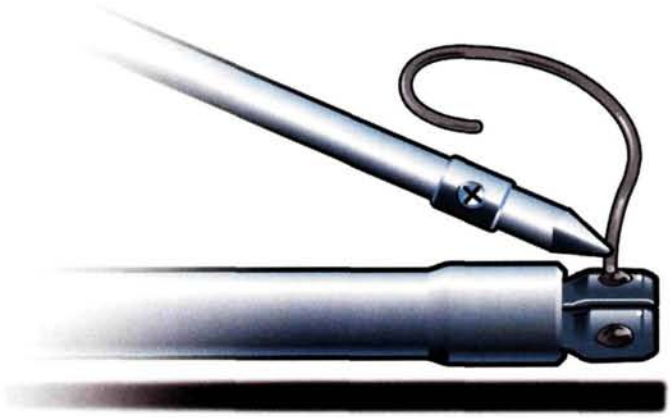
Do you have a golf club that you "retired" over your knee after a triple bogey on the 18th, or maybe one that's just taking up space in the garage? If you do, you have the makings of the ultimate chicken stick. Just saw it down to your preferred length; the club's padded grip makes a positive, no-slip surface for engaging the prop.

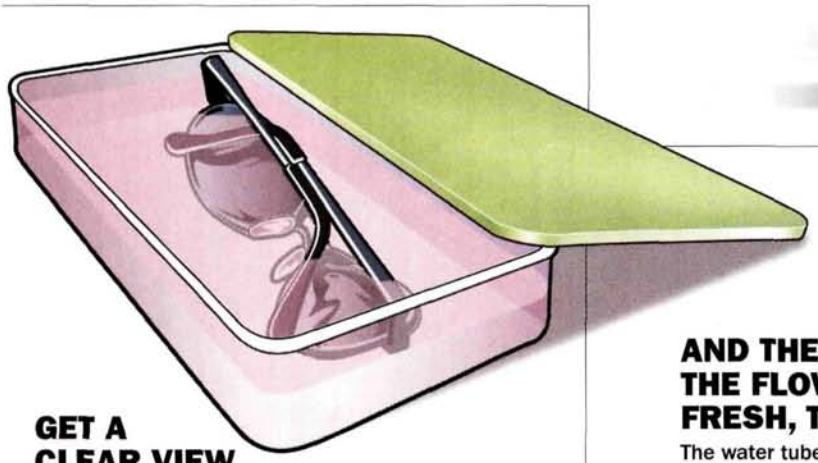
Bob Johnson, Palm Beach Gardens, FL

RESTORE GRIP TO YOUR GLOW IGNITER

The end of your glow-plug igniter can wear out rather quickly and lose its grip on the plug. This makes it apt to fall off while you're trying to start your engine, and if it falls into the path of the prop, it can cause damage. Restore a tight fit by placing a dab of solder on the outside of each of the brass plug tabs. This will allow the steel sleeve to tighten the tabs against the plug and hold the igniter more securely.

Roy Rault, Calgary, Alberta, Canada





GET A CLEAR VIEW

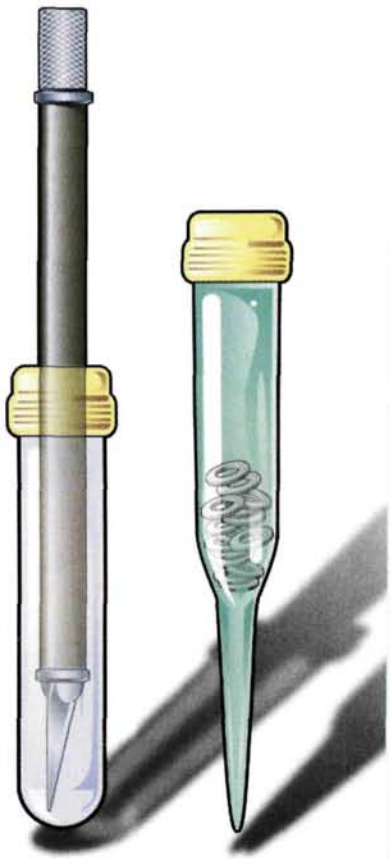
CA has a tendency to get on everything if you're not careful—your model, your tools, your workbench and you. One particularly sticky problem is cleaning it from delicate items such as eyeglasses. A good "solution" is to soak your glasses overnight in household ammonia. Find a screw-top jar or another sealable container to contain the fumes, fill it with ammonia, submerge the glasses, screw the top on and let them soak. In the morning, you'll be able to wipe the CA off the lenses with a paper towel. [email]

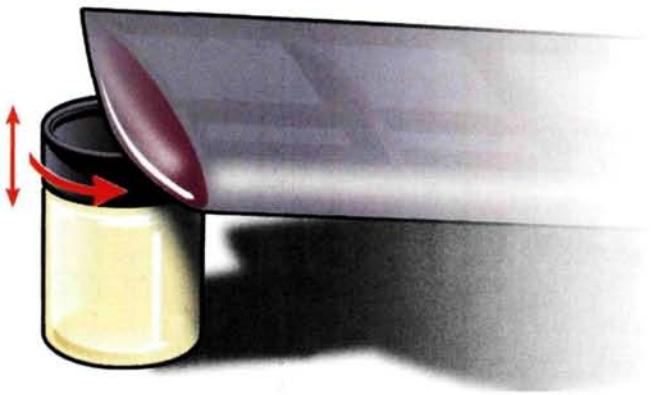
Vance Mosher

AND THEY KEEP THE FLOWERS FRESH, TOO!

The water tubes that florists push onto the bottoms of flowers to keep them fresh make great small parts containers for modelers. Their rubber stoppers tightly seal the tops to hold in screws, washers, etc. They also make great holders for hobby knives. The tubes are available in two styles—pointed and with rounded ends. The pointed ones can be dropped into screwdriver slots on your workbench or field box for easy access. Take home a bunch of flowers to earn some points with your lady, and you'll get some useful hobby-parts containers in the bargain!

Manny Duarte, Everett, WA

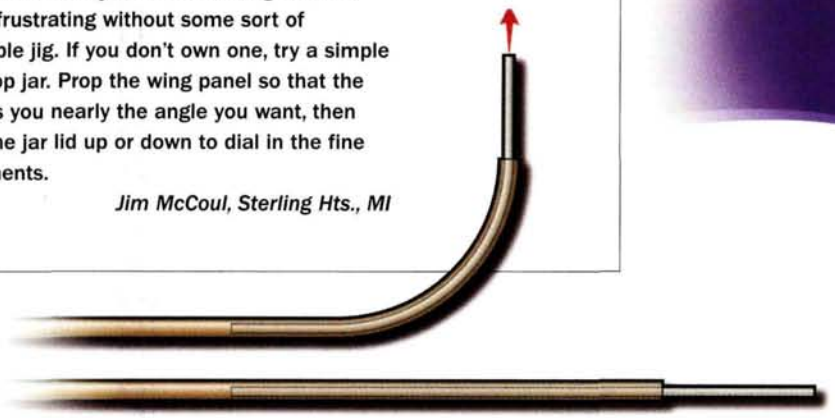


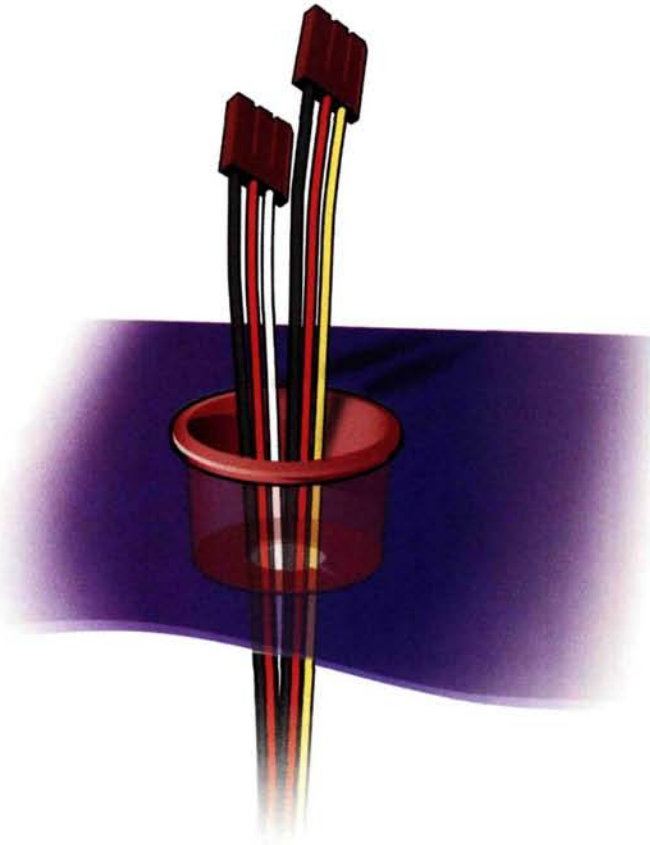


IF YOUR WING IS AJAR . . .

Making minute adjustments to wing dihedral can be frustrating without some sort of adjustable jig. If you don't own one, try a simple screw-top jar. Prop the wing panel so that the jar gives you nearly the angle you want, then screw the jar lid up or down to dial in the fine adjustments.

Jim McCoul, Sterling Hts., MI





SECURING SERVO WIRES

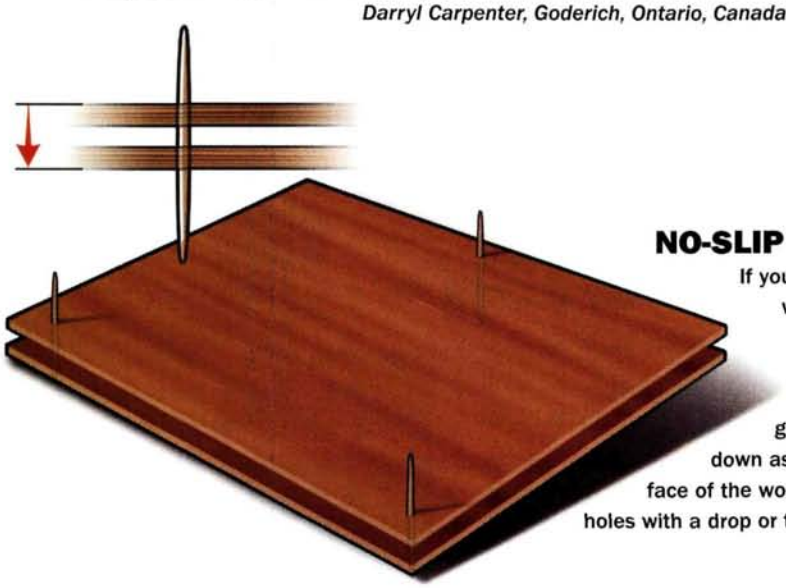
At one time or another, most of us have had to fish for a servo extension wire that slipped back inside the wing; but there is a solution. Cut a 3/16-inch hole in the bottom of the red plug from an old bottle of epoxy. Across the hole, cut a slot that's just wide enough to squeeze the connector at the end of your servo extension through. Trim the access hole in the wing to fit the plug, and you'll never have to go fishing again. This trick also works well for hold-down bolts.

Richard Rader, Bridgeport, WV

SMOOTH BENDING TUBE

Fuel-tank assembly often requires that you bend a piece of brass tube at a relatively sharp angle for the vent line, and this can cause the tube to collapse. A good technique to produce smooth bends is to insert a length of standard copper household wire (14-2NMD works with an 1/8-inch-diameter tube) into the tube, past the bend radius. Bend the tube gently, starting with the open end and progressing toward the radius. The wire is soft enough to bend with the tube but will prevent it from flattening out. When you have the angle you want, pull out the wire by hand or with a pair of pliers.

Darryl Carpenter, Goderich, Ontario, Canada



NO-SLIP SHEETING TIP

If you have trouble with wood sheets slipping out of position when you glue two together, "pin" them with toothpicks. Clamp the pieces in the position you want them, then drill two or three guide holes through them. Insert the toothpicks to maintain proper alignment while your glue dries. If you need a flat weight to press the wood down as the glue dries, simply break off the toothpick at the surface of the wood. With balsa, it's a good idea to strengthen the guide holes with a drop or two of CA before you insert the toothpicks.

Walt Calkins, Kansas City, MO

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable but please do not send digital printouts. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Hank Christman, Ocala, FL
DELTA VORTEX

Hank, a member of the On Top of the World RC Flyers in Ocala, FL, is pretty proud of his Bruce Tharpe Engineering Delta Vortex—as well he should be! An O.S. .61 engine powers this sleek model, and a Futaba 6-channel FM radio guides it across the skies above Ocala. Hank covered his 8-pound model entirely in MonoKote and he says it has absolutely no bad habits; it's capable of stall-free flight and gentle landings, and it's a pleasure to fly!

Tom Minegar and John Clark, Carlsbad, CA
NORTHROP N9MB FLYING WING

Tom and John built this 1/8-scale Northrop N9MB flying wing from Northrop factory drawings. Powered by two Graupner Speed 480 motors, Tom's and John's model sports the same airfoil, elevons and trim surfaces as its 1940s-era full-scale counterpart. It took nearly five months to complete this model, and to date, it has made 20 successful flights. According to Tom, the model flies beautifully in Carlsbad's slope lift, and it can also be towed or bungee launched. Their next project?—a 1/4-scale version of the same plane.

Mark Glazer, Cary, NC
LOVING-WAYNE RACER

Model Airplane News considered this Loving-Wayne racer a "Plane Worth Modeling" in the September 1958 issue, and apparently, Mark Glazer agrees. Mark sent us this photo of "Loving's Love," which he scratch-built to 42-percent scale from an original set of Wayne Aircraft plans. Mark powers his 43-pound model with a 3W 1.20 engine turning a Fuchs 28x12 prop.

Eldio and Gui Gomes, Herndon, VA
URUBU

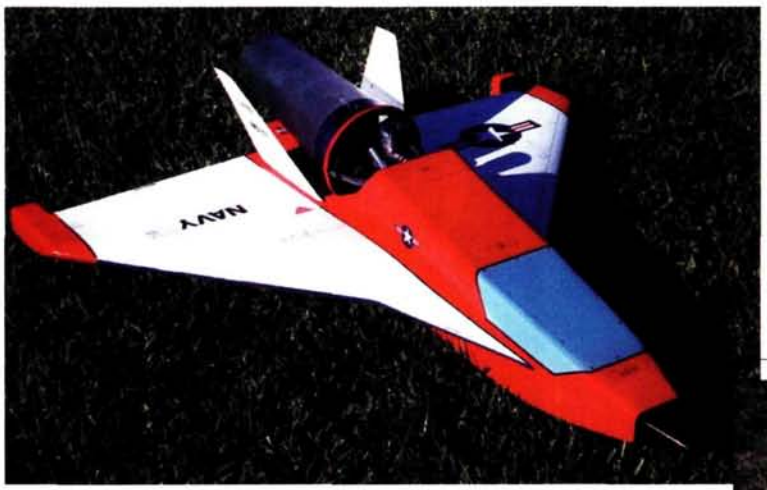
This father-and-son team designed and built this unique 63-inch Urubu, shown here with the youngest Gomes. Named after a Brazilian blackbird, the Urubu (which means vulture) is powered by an O.S. .40 engine and is equipped with flaps. According to the elder Gomes, the Urubu is extremely maneuverable, both on the ground and in the air.

Brandt Jasper, Minneapolis, MN
BYRON SUKHOI

Thanks to Brandt Jasper for sending us this photo of his .60-size Byron Sukhoi. Built by Starflight Aircraft Factory, Brandt's model is powered by an O.S. .91 FX engine with an RC McDaniels glow ignition, and it's finished with PPG paint products. It's equipped with Futaba radio gear and a TME smoke system. This aerobatic beauty can be found soaring above the Tri-Valley RC Club flying field in Rosemount, MN.

Keith Sparks, Fort Worth, TX
L-19 BIRDDOG

It took Keith six months to complete this L-19 Birddog, which he built from a set of Vailly Aviation plans. Powered by an O.S. 3.20 Pegasus engine and controlled by a Futaba Sky Sport radio, Keith's 26-pound scale beauty features landing and navigation lights, a working strobe light and an onboard glow-ignition system. Both cowl halves open, as do the cabin doors. Keith even baffeled the engine cooling system to scale. He covered his model with 3/4-ounce glass cloth and Zap finishing resin and then painted it with Hobby Poxy. Keith says, "She's a real joy to fly." Keith, we think it's quite a joy to look at, too.



Jack Scheider, Austin, TX
DUCTED-FAN NORTHSTAR

Jack has been building models since the 1940s, and he has experience with everything from rubber power to helicopters. He definitely must have called on his decades of experience when he built this ducted-fan model. Jack covered it in 21st Century fabric and finished it with Hobby Poxy paint. By using elements of the Northstar design, Jack also made this model capable of flying from water. That's right—a ducted fan that flies off water! The model is powered by a Rossi .81 engine with a Byron fan unit, and according to Jack, it really accelerates on step.

Thomas Duncan, Fruitland, MD
GOLDBERG ULTIMATE

Tom sent us this photo of his Goldberg Ultimate, which he built himself. There's nothing like a biplane to grab some attention at the flying field, and we're willing to bet that Tom's stylish model grabs its fair share. Covered entirely with MonoKote, Tom's Ultimate weighs in at 8.5 pounds. Powered by a Saito 1.50 engine, it's capable of unlimited performance.

Geoff Goldsmith, Surrey, England
DACTYL

There's definitely something to be said for variety, and this Dactyl is nothing if not unique. The photo comes to us from Geoff Goldsmith. Powered by an O.S. .48 Surpass engine, Geoff's Dactyl features a steerable nosewheel that's controlled with the rudder channel on his trusty transmitter. Geoff installed an onboard electronic mixer and a servo for each elevon. According to Geoff, his Dactyl has a very wide speed range and is extremely aerobatic.

Joe Di Prima, Franklin Square, NY
SUKHOI-26MX

Joe's Sukhoi seems to make quite an impression wherever it goes. It won first place in the sport-scale category at the Meroke RC Club 8th Annual Scale Contest and at the 2001 WRAM show. It's built from a Goldberg kit and covered with MonoKote and matching LustreKote paint; photos of a full-scale plane helped Joe accurately finish his replica. Joe powers his model with a Thunder Tiger 1.20 engine with a Bisson muffler and an APC 15x8 prop, and he equipped it with Futaba radio gear. Joe says that it flies really well and doesn't seem to have any bad characteristics. +

Gas Engine

by Gerry Yarrish & Melissa Jones

When you make the transition from normal-size sport .40 models to giant-scale airplanes, the biggest difference you have to deal with is the gasoline engine. For many, these big-bore hunks of metal are a mystery because they look and operate so differently from the more familiar glow-powered (nitro) engines. In practice, however, starting, running and adjusting a gasoline engine is only slightly different and no more difficult than operating any other internal combustion engine. If you can operate a chain saw or a weed trimmer, then you'll be right at home powering your next giant-scale project with a gas burner.

Gas engines are much easier to adjust and have excellent fuel efficiency; a gas engine consumes roughly ⅓ as much fuel per minute as a glow engine of the same displacement burns. Gasoline engines tolerate heat much better than glow powerplants, and they require fewer fuel-mixture adjustments to keep them happy. You might need to adjust your gasoline carburetor only once during a flying season! Though the typical gas burner produces less rpm than its glow-powered cousin, it produces more low-end torque. Thrust is produced more efficiently with that bigger, slower turning prop. Because they are heavier than nitro engines, gas engines are often used in scale airplanes that have a shorter nose moment, and their weight helps eliminate some of the lead ballast needed to balance the airplane. In giant-scale, unlimited Tournament of Champions and International Miniature Aircraft Club (IMAC) events, big-bore gas engines are the norm, and you can't argue with success!

If you're leery about using a gas engine, this guide will clear everything up.

3W Modell Motoren

The German-made 3W engines have been used in several giant-scale competitions, including the Tournament of Champions and many giant-scale unlimited air races. 3W engines come with an electronic auto-advance ignition system and are designed to operate at lower rpm for more thrust and less prop noise.

3W 60I (shown)—$519.

Distributed by Aircraft Intl., 8 Country Meadow Dr., Colts Neck, NJ 07722; (732) 761-0997; www.aircraft-intl.com; and **Cactus Aviation,** 10380 E. Heritage, Tucson, AZ 85730; (520) 721-0087; www.cactusaviation.com.

BME

Designed specifically for light overall weight while retaining excellent crankcase stiffness and crankshaft support, BME engines are known for their smooth operation and user-friendliness. Most BME engines come with the CH syncro spark-ignition system and fiber-reed induction (except the BME 44 single, which is piston ported), plus a 2-year warranty.

BME 102 (shown left)—$1,149; BME 44 (shown right)—$499.

BME Engines, 10101B Cordoba Ct., Waco, TX 76708; (254) 836-0835; www.bmeengine.com.

Brison Aircraft

Designed with giant-scale modelers in mind, Brison engines' enhanced power and reliability make them ideally suited to Sunday fliers, scale modelers and IMAC competitors. Available in six sizes, ranging from a 2.4ci (39.33cc) single to a big 6.4ci (104.64cc) twin cylinder, all Brison engines come standard with nicasil-lined cylinders, metal bellcranks and anodized cases, and all the crankshafts are unconditionally guaranteed for one year. Every engine is test-run and tuned before being shipped.

Brison 3.2 (shown)—$549.

Brison Aircraft, 12075 Denton Dr., Ste. 11, Dallas, TX 75234; (972) 241-9152; www.brisonaircraft.com.

Guide

HIGH-OCTANE PERFORMANCE FOR GIANT SCALE

Desert Aircraft

Using some of the latest tools and techniques, including 3D CAD and stereo lithography, the DA-150 has been designed from the ground up with Tournament of Champions and World Masters-style competition aerobatics in mind. The DA-150 is ideally suited to aircraft for which existing 120cc and 140cc engines aren't quite enough. It can also power aircraft that are designed for heavier, 4-cylinder, 160cc engines.

DA 150 (shown)—$1,495.

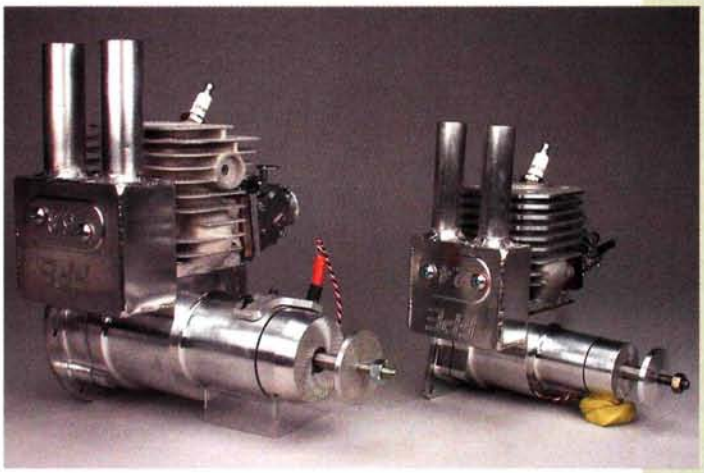
Desert Aircraft, 140 S. Camino Seco, Ste. # 418, Tucson, AZ 85710; (520) 722-0607; www.desertaircraft.com.

First Place Engines

Distributed by Sig Mfg., the First Place Engine (FPE) line consists of four, light, powerful gas engines designed specifically for large RC aircraft use. They offer a good power-to-weight ratio and come with a light, tig-welded, custom aluminum muffler that may be modified to accept a smoke system. All four engines come with an electronic ignition, complete instructions and a one-year warranty; a 50:1 oil/gas ratio is recommended.

FPE (5.8ci, shown left)—$699.95; FPE (2.4ci, shown right)—$499.

Sig Mfg. Co. Inc., P.O. Box 520, Montezuma, IA 50171-0520; (800) 247-5008; www.sigmfg.com.



FIRING UP A GAS ENGINE

Always ask a helper to assist you when you start a gas engine; make sure he knows how to operate the choke and how to shut off the engine.

Before you start a gasoline engine for the first time, it is best to review and become familiar with its operation manual. Even for bench-running, always have a helper. If the engine is already installed in a model, fully assemble the model and have your helper hold it securely. Tell him how to turn the ignition on and off and how to operate the choke, if the engine has one.

If your engine has an electronic ignition system, make sure that it is attached properly and that the ignition battery is fully charged. If you have a magneto-equipped engine, always install a kill switch to stop the engine. For the very first engine run, close both the high- and low-end needles fully, and then open the high-end needle 1½ turns and open the low-end (idle) needle 1¼ turns. These settings are a good starting point for a reliable idle and a rich high end. Check the manual for the recommended oil-to-gas mix ratio, and fill the tank with fresh, filtered fuel.

STARTING THE ENGINE

Be sure that the ignition, or the kill switch, is turned off. Set the throttle full open, and close the choke. If the carb does not have a choke, use your thumb to cover the venturi to choke it. Turn the prop counterclockwise several times until fuel starts to flow through the fuel line to the carb. Flip the prop a few more times until fuel is in the carb.

If your engine does not have a choke, turn the ignition on, set the throttle to ¼, and flip the prop until the engine begins to run. If you have a choke-equipped carb, leave the choke closed, turn the ignition on, open the throttle fully, and flip the prop until you hear the engine cough as it tries to start. Then open the choke, set the throttle to ¼, and flip the prop several times until the engine starts. If it does not fire, begin again from the start; let the engine warm up for a few minutes before you advance the throttle.

OIL-TO-GASOLINE RATIOS

The 2-stroke, air-cooled, giant-scale engines we use to power our models do not have separate oil tanks (unlike full-size aircraft engines), so we must add the oil to the gasoline. Your engine manufacturer provides a mixture ratio recommendation in the engine's operation manual. Here are some common ratios.

Ratio	Ounce of oil per gallon of gasoline
100:1	1.28
90:1	1.42
75:1	1.7
64:1	2
50:1	2.5
40:1	3.2
32:1	4
24:1	5.3
16:1	8

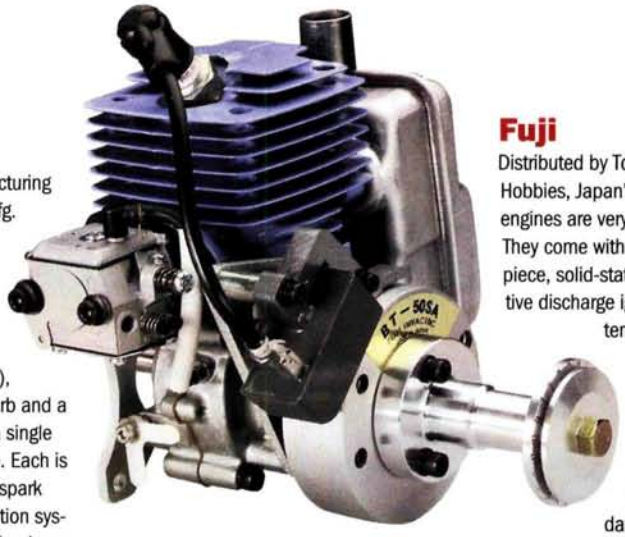
Use premium-quality 2-stroke engine oil (available at most automotive-and motorcycle-parts shops) when you mix your fuel.

Fox Mfg.

With its long history of manufacturing model airplane engines, Fox Mfg. offers custom-built RC aircraft engines. Each has a nicasil-lined cylinder/piston assembly (made by Makita/Dolmar USA), a Walbro pumper carb and a cantilevered crankshaft with a single bolt (⅜-24NF-thread) prop hub. Each is equipped with mechanical auto-spark advance with a CH electronic ignition system. The crankcase is machined aluminum with a polished finish; the cylinder is bead blasted.

Fox 3.2 (shown)—$575.

Fox Mfg., 5305 Towson Ave., Fort Smith, AR 72901; (479) 646-1656; www.foxmanufacturing.com.



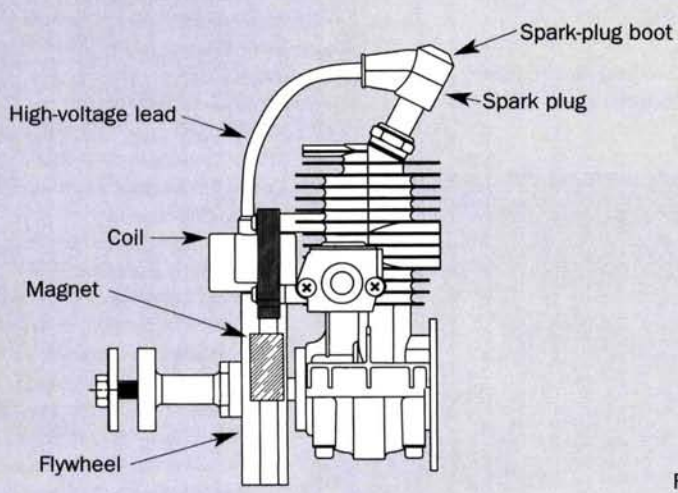
Fuji

Distributed by Tower Hobbies, Japan's Fuji engines are very popular. They come with a one-piece, solid-state capacitive discharge ignition system (no breaker points). The Walbro carburetor is standard, and the propeller hub is knurled to hold the prop securely. Three hub lengths are available. The muffler is designed specifically for RC use.

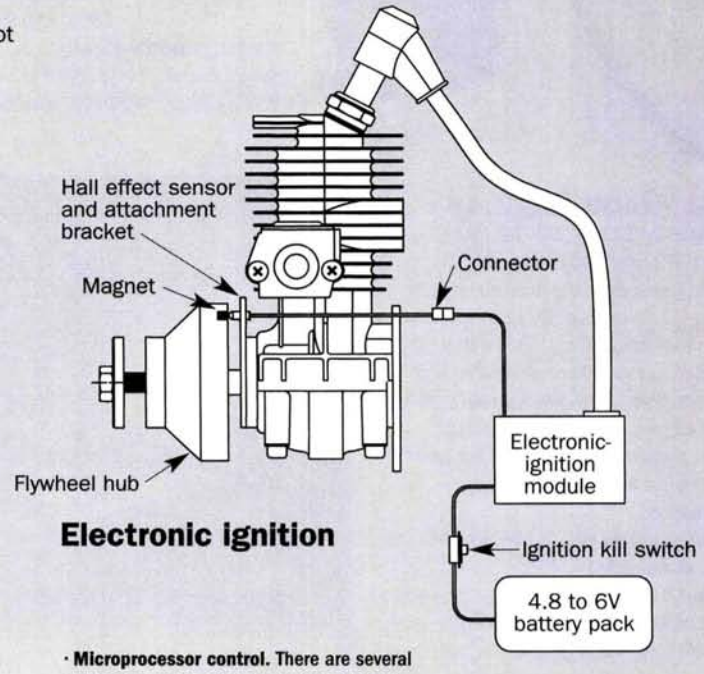
Fuji BT-50SA (2.1ci, shown)—$399.99.

Distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 637-7660; fax (217) 398-0008; www.fujiengines.com.

Engine-ignition system



Magneto ignition

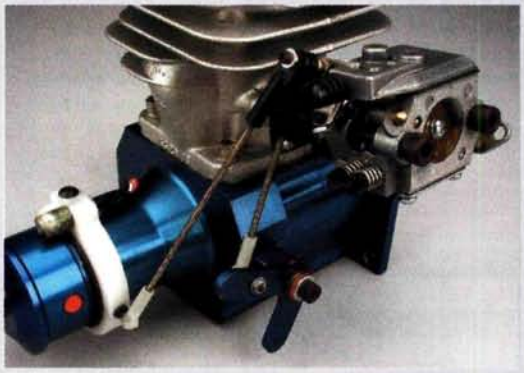


Electronic ignition

IGNITION TIMING

Many manufacturers offer their engines with either a magneto or an electronic ignition system. Depending on your requirements, either type will provide reliable performance. In addition to supplying the spark plug with current, ignition systems also regulate engine timing. Magneto ignitions have fixed timing, while with electronic ignitions, you can advance or retard the timing. Electronic ignitions can be microprocessor controlled (with auto-spark advance) or equipped with a mechanical timing-advance ring that is coupled to the throttle.

· **Fixed timing.** With a fixed ignition timing, the engine must operate in a timing range that maintains a good power setting while still being fairly easy to start. Since a good starting timing is between 0 and 5 degrees before top dead center (BTDC), and maximum power is achieved at somewhere around 25 to 30 degrees BTDC, engines with fixed timing cannot offer optimum performance. Engines that are timed for optimum high-end output offer good overall performance but do not idle as low as those with adjustable timing.



This Brison 3.2ci engine has a mechanical timing-advance ring coupled to its throttle arm. The ring advances and retards the engine timing as the throttle settings are changed.

· **Microprocessor control.** There are several microprocessor-controlled timing units on the market. They have a fixed timing sensor placed at a specific timing setting and use a microprocessor to change the timing to suit the engine's rpm. They work very well, but they are usually limited to about 25 degrees of timing (advance or retard).

· **Mechanical advance.** Engines with a mechanical timing-advance ring tend to be very easy to start and can be adjusted to optimize an engine's full power range. Usually made of a non-metallic material, the ring holds the timing sensor; this ring is coupled to the throttle arm, and it moves the sensor to change the timing from 0 degrees BTDC for starting up to about 30 degrees BTDC for optimum top-end performance.

MAGNETO MAGIC

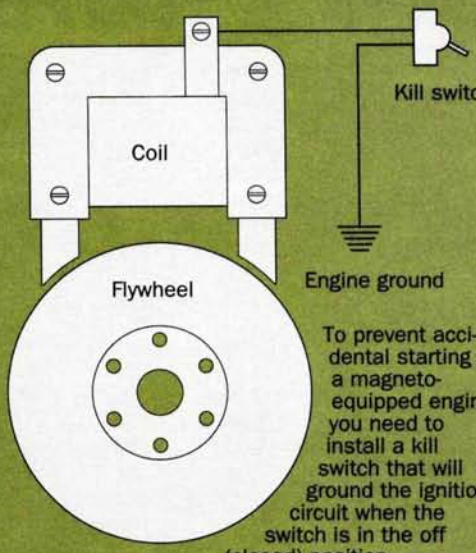
A magneto ignition is nothing more than an old-fashioned generator used to create a pulse of electrical current to fire the spark plug. The magneto ignition system consists of a permanent magnet mounted on a flywheel attached to the crankshaft and a field coil that induces the current when the magnet passes the ends of the coil shoes. The magnet is embedded in the flywheel's rim, and the coil sits right next to the flywheel. A battery isn't required for ignition.

With a magneto-equipped engine, use a kill switch to stop it safely. The switch simply grounds the magneto coil to the engine case and prevents current from firing the spark plug.

Many magnetos have an external secondary coil (or condenser); the current builds up in the primary coil and is then dumped into the condenser to produce a stronger spark while starting the engine. Magneto ignitions are completely self-contained, and if set up properly, they will supply current to the spark plug for as long as the engine is running. To stop the engine, the coil must be grounded to the engine case. A kill switch grounds the magneto coil to the engine case and prevents current from firing the spark plug.

To operate properly, the spark-plug gap and the coil gap (space between the flywheel magnets and the primary magneto coil) must be set up according to the engine's operating manual. For most engines, a spark-plug gap of between 0.018 and 0.025 inch and a coil gap of between 0.020 and 0.025 inch is recommended.

Kill switch installation



To prevent accidental starting of a magneto-equipped engine, you need to install a kill switch that will ground the ignition circuit when the switch is in the off (closed) position.

Quadra-Aerrow ▶

Manufactured since 1975, Quadra-Aerrow engines are among the most reliable and durable in the RC industry. Available in nine sizes and 17 variants, they produce from 3.9 to 45hp and can be equipped with battery-powered or magneto ignition systems. Ideal for aerobatics competition, all except one feature a reed-valve induction system for quick throttle response and high-torque midrange performance. Features include chrome or nicasil-plated cylinders with high-silicon/aluminum pistons, single and dual piston rings (pegged and chamfered), ball-bearing and needle-bearing support throughout, and on some models, semi-automatic compression release.

Q75B (shown)—$734.

Quadra-Aerrow Inc., P.O. Box 183, Perth, Ontario, Canada K7H 3E3; (613) 264-0010; www.quadraaerrow.com.

Cheetah ▶

Reid's Quality Model Products offers the Cheetah engine with magneto ignition, and the 42DX version with the CH electronic-ignition system with syncro-spark throttle linkage. Suitable for 15- to 25-pound airplanes, the Cheetah 42DX has a chrome-plated cylinder bore and includes a backplate engine mount and spacer, an adjustable velocity stack, a muffler and a 2-year limited warranty.

Cheetah 42DX (shown)—$399.95.

Distributed by Reid's Quality Model Products, 30 Clifton St., Phelps, NY 14532; (315) 548-3779; www.reidsmodels.com.

RCS ▶

RCS engines are available in displacements that range from 1.4 to 18ci. Designed to replace large glow engines, they deliver as much or more power as glow engines of the same displacement. The engines are equipped with electronic auto-advance computerized ignition. Available as side- and rear-exhaust versions, RCS engines are very easy to hand-start and have linear throttle response.

RCS 140 (shown)—$345.

RC Showcase, 3442 Gough Dr., Waldorf, MD 20602; (301) 374-2197; www.rcshowcase.com.

ZDZ ▶

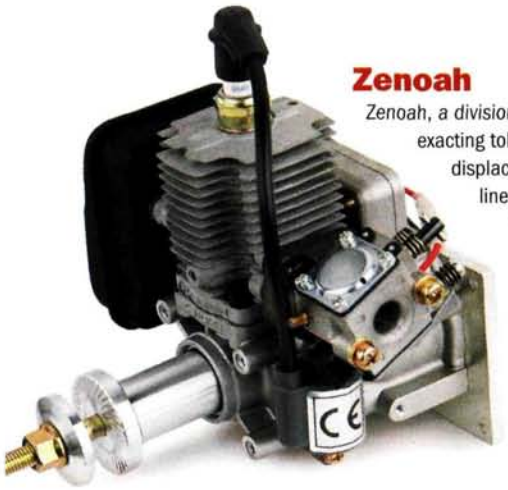
Manufactured in the Czech Republic and distributed in the U.S. by RC Showcase, ZDZ giant-scale gas engines have rotary disc valves and rear-induction carburetors (complete with control links for the choke) and throttle arms. All have a solid-state microprocessor-controlled electronic ignition with auto-advance and are completely shielded to minimize interference. Even the spark-plug lead is fully metal-shielded. ZDZ engines come with a 30-month warranty.

ZDZ 40 RV-L (2.4ci, shown)—$410.

Distributed by RC Showcase, 3442 Gough Dr., Waldorf, MD 20602; (301) 374-2197; www.rcshowcase.com.

ENGINE INFORMATION

Engine	Price	Bore (in.)	Stroke	Cylinders	Displacement (ci)	Weight (lb.)	Horsepower	Overall dimension (in.)
3W Modell Motoren								
3W-100iB2	$1,099	1.73	1.26	2	5.9	7	9.3	11.1x4.6x7.6
3W-105STR3	$2,475	1.58	1.1	2	4.3	10.1	11	14.4x4.4x9.4
3W-120iB2	$1,150	1.8	1.42	2	7.2	8.47	11.5	12.4x3.9x6.9
3W-120iB2F	$1,150	1.8	1.42	2	7.2	8.47	11.5	12.4x4.9x7.7
3W-140iB2	$1,199	1.88	1.49	2	8.3	8.58	13.5	13x3.9x6.9
3W-140iB2F	$1,199	1.88	1.49	2	8.3	8.58	13.5	13x4.9x7.7
3W-150iB2	$1,325	1.93	1.57	2	9.2	8.47	16.5	13x3.9x6.9
3W-150iB2F-TS	$1,625	1.93	1.57	2	9.2	8.47	17.5	13x4.9x7.7
3W-150iB2-TS	$1,625	1.93	1.57	2	9.2	8.47	17.5	13x4.9x7.7
3W-150iR2	$1,795	1.93	1.57	2	9.2	10.14	16.5	6.5x8x10.25
3W-150iR2-TS	$1,895	1.93	1.57	2	9.2	10.56	17.5	6.5x8x10.25
3W-156B4	$2,075	1.65	1.1	4	9.4	11.88	14.8	11x6.3x8.7
3W-170B4	$2,175	1.73	1.1	4	10.3	11.7	16.5	11x6.3x8.7
3W-240iB2	$2,150	2.26	1.8	2	14.4	14.74	22	14.17x5.5x8.7
3W-24i	$449	1.34	1.03	1	1.5	2.32-2.65	2.5	6.5x2.75x3.9
3W-38i (42.5cc)	$479	1.34	1.03	1	1.5	3.97	4	7.2x3.5x4.6
3W-48B2	$795	1.34	1.03	2	2.9	4.11-4.45	5	10.3x3.5x5.5
3W-50i	$499	1.73	1.26	1	3.0	4.36	6	3.5x5.8x5.8
3W-60i	$519	1.81	1.45	1	3.7	5.32	6	3.9x6.2x6
3W-70i	$575	1.88	1.49	1	4.1	5.32	6.5	3.9x6.4x6
3W-70iUS	$575	1.88	1.49	1	4.1	4.73	6.5	3.9x6.4x5.5
3W-75i	$619	1.93	1.57	1	4.6	5.32	7.5	3.9x6.4x6
3W-75iTS	$775	1.93	1.57	1	4.6	5.42	7.9	3.9x6.4x6
3W-75iUS	$619	1.93	1.57	1	4.6	4.73	7.5	3.9x6.4x5.5
3W-75iUS-TS	$775	1.93	1.57	1	4.6	4.83	7.9	3.9x6.4x5.5
3W-85iB2	$999	1.73	1.1	2	5.2	6.49	7.8	11x3.5x5.7
A.J. Machine								
Wolf Predator 1.8	$528.95	±	±	1	1.8	3.28	3.6	5.5x4.5x4.3
Wolf Predator 3.2	$649.95	±	±	1	3.2	3.75	5.2	6x6x4.5
BME								
BME-102	$1,149	1.77	1.26	2	6.2	4.7	9.1	10x6x8
BME-44	$499	1.69	1.18	1	2.7	2.7	4.2	6.75x4.3x6.25
BME-61	$995	1.42	1.18	2	3.7	4.2	6.4	8.62x6x8
BME-80	$1,079	1.57	1.25	2	4.9	4.7	7.5	10x6x8
BME-50	±	1.77	1.22	1	3	3	4.8	±
Brison Aircraft								
2.4ci	$449	1.57	1.22	1	2.4	2.75	4.5	5.375x5x4.625
3.2ci	$549	1.73	1.34	1	3.2	3.25	5	6x 5.375x5.25
4.2ci	$649	1.92	1.41	1	4.2	4.75	7.5	6.75x6x6.4.9
4.8ci	$999	1.57	1.22	2	4.8	5.63	8.5	5.5x5.875x8.75
5.8ci	$699	2.16	1.57	1	5.8	6	9	6.5x5.75x6
6.4ci	$1,199	1.73	1.34	2	6.4	6	9.4	5.5x6x9.75
D&B Engines								
3.7ci	$995	1.42	1.18	2	3.7	5	N/A	10.2x5.9x8.8
5.1ci	$1,195	1.65	1.18	2	5.1	6.4	N/A	10.9x5.5x8.9
Desert Aircraft								
DA-100	$1,150	1.68	1.38	2	6.1	5.8	9.8	11.5x3.5x6.3
DA-150	$1,495	1.93	1.57	2	9.2	8	16	13.4x4.5x7.7
First Place Engines								
FPE 2.4ci	$499	1.65	1.22	1	2.4	3.2	4	5x6.1x7.6
FPE 3.2ci	$579.95	1.73	1.34	1	3.2	3.6	5	6x7.25x7.58
FPE 4.2ci	$639.95	1.92	1.42	1	4.2	5.5	6.5	6.5x8.3x9.3
FPE 5.8ci	$699.95	2.17	1.57	1	5.8	5.9	9.5	7x8.1x9.5
Fuji								
Bt-32A	$299.99	1.14	1.49	1	1.5	3.74	2.2	7.5x5x4.4
Bt-86	$849.99	1.18	1.68	2	3.7	6.38	7.5	7.75x8.6x3
Bt-50SA	$399.99	1.26	1.69	1	2.1	5.28	5.2	8.5x5.5x4.8
Quadra-Aerrow								
A 150B	$1,795	1.97	1.5	2	9	9.5	13.5-17	7.8x10x8.8
A 200B	$2,095	2.25	1.5	2	11.9	11.3	17-21	7.8x10.3x8.8
A 200RSS	±	2.25	1.5	2	11.9	10.4	23.5-27+	7.8x10.3x8.8
Q 1000B	$1,199	1.65	1.5	2	6.4	6.5	9.4 min.	6.1x10.3x6.8
Q 100B	$839	2.25	1.5	2	6	6.9	9.5-11.9	9x6.8x6
Q 100M	$734	2.25	1.5	2	6	8.3	9.5-11.9	9x6.8x6
Q 100RSS	±	2.25	1.5	2	6	6.6	11.5-16+	9x6.8x6



Zenoah

Zenoah, a division of Komatsu Zenoah, manufactures 2-stroke engines to exacting tolerances at its factory in Japan. Available in 1.3 to 4.87ci displacements, Zenoah engines come with chrome-plated piston liners and are equipped with compact, maintenance-free CDI-type flywheel/magneto ignition systems. Each engine comes with a muffler, an engine mount, a spark plug and plug wrench and a Walbro pumper carb. The G-23 is available in airplane gasoline and glow-plug (nitro), helicopter and marine versions. The twin-cylinder GT-80 has a cast intake manifold and a spring starter.

G-23 (shown left)—$289; GT-80 (shown right)—$999.95.

Distributed by Horizon Hobby Inc., 4105 Fieldstone Rd., Champaign, IL 61822; (800) 338-4639; www.horizonhobby.com.

Engine	Price	Bore (in.)	Stroke	Cylinders	Displacement (ci)	Weight (lb.)	Horsepower	Overall dimension (in.)
Quadra-Aerrow (cont'd)								
Q 400B	$438	1.58	1.18	1	2.3	3.19	3.9	6x5x6.38
Q 400M	$358	1.58	1.18	1	2.3	4.16	3.9	6x5x6.38
Q 52B	$525	1.65	1.5	1	3.2	4.1	4.5	7.6x5x6
Q 52M	$424	1.65	1.5	1	3.2	5.1	4.5	7.6x5x6
Q 65M	$583	1.88	1.44	1	4	6.5	6.8	8.6x6.2x6.95
Q 75B	$734	1.97	1.44	1	4.4	5.2	8-10	8.6x6.2x6.95
Q 75M	$629	1.97	1.44	1	4.4	6.5	8-10	8.6x6.2x6.95
Q 75RSS	±	1.97	1.44	1	4.4	5.1	10-12	8.6x6.2x6.95
RC Showcase								
RCS 140	$345	±	±	1	1.4	1.75	2.9	4.5x2.35x3.6
RCS 180	$369	±	±	1	1.8	3	4	7.3x4x4.92
RCS 215	$2,650	±	±	5	13.1	12	13.5	11.5x7.9
RCS 44 B2	$635	±	±	2	2.8	4.2	4.8	10.5x4.5x7.25
RCS 75	$505	±	±	1	4.6	5	7.5	7.88x4.3x5
RQ Model Products								
Cheetah 42	$279.95	±	±	1	2.5	4.5	3	5x6x6.5
Cheetah 42DX	$399.95	±	±	1	2.5	3.9	3	5x6x6.5
Taurus Engines								
TS 42	$529.95	±	±	1	2.6	3.13	3.9	5.9x5.6x5.44±±
TS 52	$559.95	±	±	1	3.2	3.31	5	5.8x2.58x4.61±±
TS 62	$589.95	±	±	1	3.7	4.5	5.8	7.29x3x5.13±±
TS 69	$640.95	±	±	1	4.2	4.75	6.4	7.29x3x5.13±±
TS 72	$699.95	±	±	1	4.4	4.94	8.1	6.68x3x4.8±±
TS 95	$758.95	±	±	1	5.8	5	7.2	7.29x3.22x5.55
TT 85	$1,115	±	±	2	5.2	4.5	±	±
TT 107	$1,225	±	±	2	6.6	±	±	±
TT 122	$1,325	±	±	2	7.5	±	±	±
TT 144	$1,450	±	±	2	8.8	±	±	±
TT 185	$1,655	±	±	2	11.4	±	±	±
TT 240	$2,190	±	±	2	14.6	±	±	±
US Engines								
US 35cc	$229	1.57	1.28	1	2.5	4.5	2.4	6.5x6x6
US 41cc	$249	1.44	1.28	1	2.1	4.5	3	6.5x6x6
ZDZ								
120 B2 RV	$985	1.77	1.50	2	7.3	6.4	10.5	12.6x3.3x7.8
160 B2 RV	$1,100	2.05	1.50	2	9.8	6.6	16	12.75x3.3x7.7
210 B2 RV	$1,475	2.05	1.97	2	12.8	9.6	21	14.3x3.9 x10.8
40 RV-L	$410	1.50	1.38	1	2.4	2.9	4.8	6.2x3.35x5.2
60 RV	$490	1.77	1.50	1	3.7	4.2	5.4	7.75x3.33x5.9
80 B2 RV-L	$870	1.50	1.38	2	4.9	4.2	8.1	11.5x3.33x7.95
80 RV	$590	2.05	1.50	1	4.9	4.3	8.5	11.5x3.33x7.95
Zenoah								
G-23	$289.95	1.3	1.1	1	1.4	3.19.	2.0	7.09x6.67x7.09
G-38	$299.95	1.5	1.3	1	2.3	4.19	2.5	7.72x3.55x5.38
G-45	$399.95	1.7	1.2	1	2.8	4.31	3.3	7.99x3.94x6.78
G-62	$424.95	1.9	1.4	1	3.8	4.56	4.75	8.55x3.94x6.75
GT-80	$999.95	1.2	1.2	2	4.9	6.75	5.8	7.99x3.94x6.78

± Manufacturer did not supply info.
±± Height is from crankshaft center to top of cylinder.

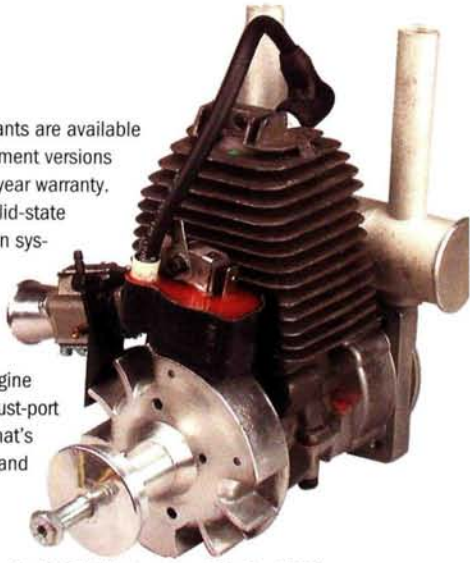
Taurus Engines

Taurus Engines offers single- and twin-cylinder engines. The singles range from the TS 42 (2.6ci) to the TS 95 (5.8ci), while the twins (inline and opposed-cylinder configurations are available) range from the TT 85 (5.2ci) to the TT 240 (14.6ci). Taurus Engines also offers its Signature Series HP engines in displacements of 3.5ci to 7.2ci (call for prices). The 2.6 and 3.2 engines have double-web crankshaft counterbalances, 5-hole radial engine mounts, nicasil cylinder liners, auto-advance ignition systems and single-bolt prop hubs. A full 3-year warranty covers workmanship and defects on all engines.

TS 52 (shown)—$559.95.

Taurus Engines, P.O. Box 1076, Southgate, MI 48195; (734) 283-4813; www.taurus-engines.net.

U.S. Engines



These economical powerplants are available in 35cc and 41cc displacement versions and come with a limited 2-year warranty. Each is equipped with a solid-state capacitive discharge ignition system and a nicasil-coated piston liner. The Walbro carburetor is standard, and throttle linkage for RC use is also included. The engine also comes with a two-exhaust-port muffler, an engine mount that's part of the rear crankcase, and a spring starter. The spark plug comes installed.

U.S.41 (shown)—$249.

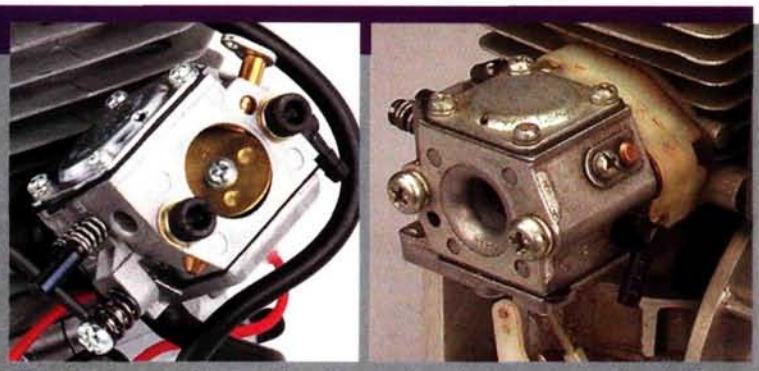
Distributed by Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 637-7660; fax (217) 398-0008; www.bestrc.com/usengines.

PUMPER CARBURETOR BASICS

For a gasoline engine to run reliably and to produce maximum power, the carburetor must be adjusted correctly. The throttle "butterfly" controls how much air enters the engine, and the needle valves meter the fuel. Walbro-type pumper carbs have two needle-valve screws: the low end—identified with an "L"—and a high end—"H"; the marks are stamped into the carb body. Turning the adjustment screws clockwise (in) leans the mixture (restricts fuel flow). When turned counterclockwise (out), the mixture is richened and allows more fuel to flow through the carb.

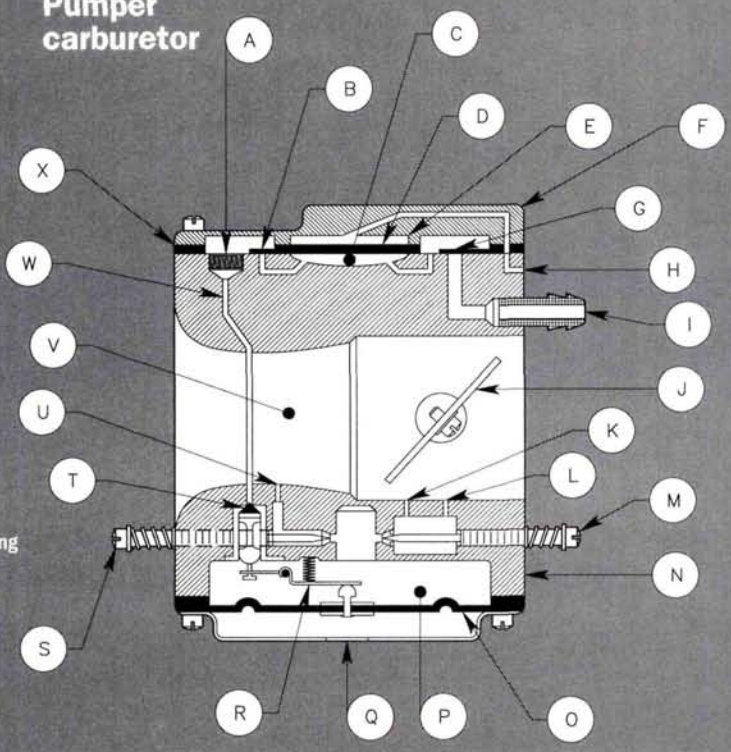
Fuel is constantly delivered to the engine by the low-end (idle) needle. As rpm increase to about 2,000 to 3,000 (the midrange), additional fuel is drawn from the high-end needle. The higher the rpm become, the more fuel is drawn from the high-end needle. A properly adjusted carb will deliver fuel evenly throughout the entire throttle range to produce a smooth throttle transition from idle to full power.

Always adjust the low-end needle first. The low-end mixture should be set as lean as possible but not so lean that the engine doesn't instantly transition from idle to the midrange. If the idle mixture is set too lean, the engine will hesitate and might quit when you advance the throttle quickly. If the idle mixture is set too rich, the engine will sputter and burble with excess fuel as you advance the throttle. You will know the mixture is correct when you advance the throttle quickly and the engine responds cleanly and quickly.



Not all carburetors have chokes; if yours doesn't have a mechanical choke, use your thumb to choke it while you rotate the prop to draw fuel into it.

Pumper carburetor



A. Fuel-inlet filter screen
B. Fuel-outlet valve
C. Fuel chamber
D. Fuel-pump diaphragm
E. Impulse chamber
F. Pump cover
G. Fuel-inlet valve
H. Impulse pressure inlet
I. Fuel-inlet fitting
J. Throttle butterfly
K. Secondary idle-discharge port
L. Primary idle-discharge port
M. Low-end (idle, needle valve)
N. Carburetor body
O. Fuel-metering diaphragm
P. Diaphragm fuel chamber
Q. Atmospheric pressure vent
R. Fuel-inlet-valve control arm and spring
S. High-end needle valve
T. Fuel-inlet needle valve
U. Main fuel-discharge port
V. Venturi
W. Fuel-inlet-supply channel
X. Fuel-pump diaphragm gasket

Set the high-end needle so that the engine will produce maximum rpm without overheating. If the high end is set too lean, the engine will sag and slow down as it overheats. Don't run your engine too lean, as this can damage it. If the high-end mixture is set too rich, the engine will run roughly and won't develop full power.

Make small needle-valve adjustments—1/16 turn at a time for the idle and 1/8 turn for the high end. Use a tachometer to adjust the high end until maximum rpm is achieved. After each new adjustment, allow the engine to run for a short time, and continue to lean the mixture until the rpm begin to drop. When this happens, back the needle off 1/4 turn (rich). Check the idle setting again, and you're done. If you do have to readjust the idle setting, readjust the high end also, as both needles affect overall performance. Once you've set it properly, you shouldn't have to adjust the carb for a long time.

To check the engine's fuel mixture, inspect the spark plug's condition. If the fuel mixture is correct, the electrode should be a light tan color (the color of a brown-paper bag). A lighter color (pasty white) typically indicates a too-lean fuel mixture, and a darker brown (or oily black) indicates an overly rich mixture.

TROUBLESHOOTING

A properly adjusted gasoline engine will run smoothly and produce maximum power for a long time. But sometimes, even a well-running engine can become difficult to start or begin to run erratically. Here are some common problems and fixes.

· **Engine won't start.** Check the fuel, air and ignition system. If any one of these three isn't correct, it will prevent the engine from firing. Make sure the kill switch is off (open). Check for a fuel-line blockage and debris in the needle-valve assemblies. Make sure that the choke and "butterfly" operate properly and that the carb body is firmly bolted into place. The pulse pressure passage between the carb and the crankcase must be clear. If you have an electronic ignition system, be sure the battery is properly charged.

Aftermarket items such as these velocity stacks can help smooth fuel flow through the carb.

· **The engine runs erratically in flight.** If the engine runs properly on the ground but then operates erratically (too rich or lean), especially when climbing or diving, the problem might be uneven airflow into the carburetor. This can cause fuel to be siphoned out of the venturi, and the mixture will be incorrect. A ¾- to 1-inch-long velocity stack will help stabilize the airflow. If this does not improve engine performance, install a small fairing, or a shield, to help direct airflow away from the carb.

To operate a gas engine, use gasoline-proof fuel plumbing. Always replace the fuel-tank stopper and all fuel and vent lines with gas-compatible ones.

· **Engine suddenly runs erratically.** If your engine has been running properly and suddenly starts to act up, you should check several things.

Make sure the ignition battery is fully charged and is supplying the proper voltage. Be sure that all electronic ignition connections are securely plugged in and that the ground strap is still attached to the engine case. Inspect the spark plug and the spark-plug wire and boot. The plug may be fouled with carbon deposits, or the wire connections may be faulty.

Often, the carburetor's internal inlet screen can become blocked, restricting fuel flow. To remedy this, remove the carb's outer cover on the fuel-inlet side, and then carefully remove the gasket. The filter screen sits in a shallow depression and can be inspected easily. If it is clogged, carefully remove and clean it by flushing it with fresh gasoline. Then carefully reinstall it and replace the gasket and cover plate. If it is not clogged, remove both needle valves and flush the entire carb with gasoline.

PREVENTIVE MAINTENANCE

Use only freshly mixed gasoline and oil; if the fuel is several months old, dispose of it properly and mix a new batch. Always drain the fuel out of the tank after every flying session. When you store your model for an extended time, first empty the tank and then run the engine until it quits; this will remove unburned fuel from the carb. Remove the spark plug and squirt some after-run oil into the cylinder, and turn the engine over by hand. Put a few more drops into the carb, and then plug the venturi and exhaust pipes with some small wads of paper towel. Remove the ignition batteries, charge them and store them in a safe place. Store your engines in a warm dry area; avoid areas that are subject to drastic temperature changes and dampness. Remove and inspect the prop occasionally to check for cracks and other damage; always balance a new prop.

QUESTIONS AND ANSWERS

Q: Which gasoline should I use?

A: High-octane gasoline will make your engine run slightly hotter but won't increase power output. I use standard 87 octane. Higher grades of gasoline (premium or ultra) contain fewer impurities and may help your engine to run more cleanly. Do not use gasoline that contains alcohol; it can damage the rubber parts of the carb. Don't use aviation-grade gasoline (AVGAS); it contains lead and has a 100-octane rating. It will make your engine run hotter, and the lead can foul the plugs. Always filter your fuel to remove contaminants and any small particles of debris that can clog your fuel system. Always use gasoline-grade fuel-tank plumbing and gasoline-rated fuel line.

Q: Which type of oil should I use, and at what ratio should I mix it with the gas?

A: Always use top-quality 2-stroke oil for air-cooled engines; it's found at most automotive- and motorcycle-parts stores. There are several brands. I have used Zenoah, Klotz and Honda XP2 high-performance synthetic oil, but you may also use high-quality petroleum-based oils. Check your engine manufacturer's recommendations; many suggest the use of petroleum-based oil during break-in, as it helps the piston rings seat faster. After about 10 hours of break-in, you can switch to synthetic oil. The ratio of gas to oil depends on the oil type (petroleum or synthetic). I usually use a ratio of between 40:1 and 64:1 (gas:oil) when using petroleum-based oils and 75:1 to 100:1 when using high-quality synthetics.

Q: Should I use a soft mount for my engine, or should I hard-mount it directly to the firewall?

A: Whether or not you use soft engine mounts is a personal preference. Most single-cylinder engines produce a fair amount of airframe vibration. Soft engine mounts absorb a certain amount of this and so shield the airframe from it. They also allow the engine to move and shake more. On lightly built aircraft structures, I use very stiff soft mounts, but I do not use them on stronger, stiffer airframes. Try them and see; it's up to you.

Some modelers use soft mounts such as these B&B Specialties mounts to cushion their engine on the firewall, and they isolate the airframe from engine vibration.

Q: Which kind of spark plug should I use, and what should the gap be?

A: Always use a resistor spark plug (indicated by the letter "R" in the model number). I have used Champion RCJ7Y, Bosch WSR6F and NGK BPMR6A and have found them all to work very well. Use a plug of the type and size recommended by the engine's manufacturer. Always check the plug gap before you use it; on most engines, a 0.018- to 0.020-inch gap works well. I use 0.022 on my Brison 3.2 as recommended by its manufacturer. Use an inexpensive spark-plug gap gauge to get it right.

The spark-plug boot and wire should always be in good condition. Here is a standard rubber boot with a grounding strap and a metal boot with shielded wire. Make sure you connect the boot to the spark plug properly.

Spark plugs come in several types and sizes; always use a resistor spark plug to minimize RF noise. Always use a spark-plug wrench to loosen or tighten your glue plugs; if you use the wrong tool, you may damage the plug, and that could increase RF noise.

Q: What is "RF" noise and how can I eliminate it?

A: This refers to radio-frequency noise and its electrical interference created by the firing of the spark plug. It can affect radio reception, but most of the newer receivers are less susceptible to it. Installing a resistor spark plug will minimize RF noise but won't completely eliminate it.

Use a non-metallic throttle pushrod to further help shield the radio from the interference. Also, install your radio gear (including ignition battery packs) as far from your engine as is practical; 8 to 10 inches should be enough (the farther apart, the better). Also check the engine, motor mount, throttle linkage and muffler for any loose metal-to-metal contact. If your electronic ignition system has a ground wire, make sure that it is grounded to the cylinder head or engine case.

The World Models Super Chipmunk

by Jim Onorato

The Super Chipmunk is one of my favorite airplanes. Over the years, I have built and flown four of them. The World Models Mfg. Co. Ltd.'s Super Chipmunk was my first almost-ready-to-fly version, and I couldn't wait to compare it with my previous efforts. The World Models produces a great many well-made, almost-ready-to-fly airplanes that are distributed exclusively by AirBorne Models. This one, decorated in the red, white and blue color scheme of the late Art Scholl's Chipmunk, is one of the most colorful.

Almost-ready-to-fly aerobat with striking appeal

The Chipmunk's first flights took place on a sunny fall day with a moderate wind. I used the recommended throws for high rate, and I set the low rates at 60 percent. I set the rate at low for the initial flight and took off from a freshly cut grass runway.

TAKEOFF AND LANDING

Because of the Chipmunk's small wheels, I was concerned that it might nose over on the grass runway, so I held in some up-elevator and throttled up quickly. It didn't have a chance to nose over; the plane leapt into the air almost immediately! The Magnum .91 showed its muscle. Subsequent take-offs were pretty routine. The plane tracked beautifully without any need for right rudder. As the tail came up, I released the up-elevator and continued to advance the throttle until flying speed was attained. Just a touch of up-elevator was all that was needed to get the Chipmunk to lift smoothly into the air.

The Chipmunk settles in nicely for landings, and this makes them a real pleasure. I set up a long approach and throttled down to establish the rate of descent while using a slight amount of up-elevator to bleed off some airspeed. I didn't notice any appreciable decrease in airspeed when the flaps were down, but I did notice an increase in stability.

LOW-SPEED PERFORMANCE

The Chipmunk flew well at slow speeds and maintained its responsiveness to the controls. Stalls were fairly gentle but not straight ahead. Recovery was always smooth and easy; however, because of the Chipmunk's inherent aerobatic capabilities, I don't recommend flying it too slow.

HIGH-SPEED PERFORMANCE

The Magnum .91 is a lot of power for the Chipmunk; it really hauls the plane around—especially with the wheels up. I don't know whether the full-scale Chipmunk ever had retracts, but they sure do "clean up" the model. I did not experience any bad tendencies with the Chipmunk at full throttle. It grooved very well at high speed.

AEROBATICS

This is what I was waiting for! The Chipmunk was designed for aerobatics, and I couldn't wait to see what it could do. I was not disappointed! It performed high-speed loops without rolling out or losing heading, and its high-speed rolls were perfectly axial. With aileron throw at high rate, the rolls were so quick that I wouldn't have had time for elevator correction even if it had been needed. It did nice, slow rolls, but elevator and rudder coordination was required. Snap rolls were very crisp. Inverted flight required only a little down-elevator to maintain altitude. Sustained knife-edge was a breeze, as were outside knife-edge circles.

Overall, I would say that the Super Chipmunk has excellent flight performance with no bad tendencies. This one is a real winner!

SPECIFICATIONS

MODEL: Super Chipmunk

MANUFACTURER: The World Models Mfg. Co. Ltd.

DISTRIBUTED BY: AirBorne Models LLC

TYPE: sport-scale ARF

WINGSPAN: 64 in.

WING AREA: 688 sq. in.

WEIGHT: 7 lb., 8 oz.

WING LOADING: 25.1 oz./sq. ft.

LENGTH: 52.3 in.

RADIO REQ'D: 6-channel w/7 servos

RADIO USED: Futaba FP-T7 UAF 7-channel transmitter, FP-R129DP 9-channel PCM receiver, five S3003 servos (ailerons, rudder, elevator and throttle), one FP-S38 servo (flaps), one FP-S136G servo (retracts)

ENGINE REQ'D: .60 2-stroke or .90 4-stroke

ENGINE USED: Magnum FS-91AR 4-stroke

PROP USED: APC 13x8

FUEL USED: Red Max 15%

STREET PRICE: $249.99

FEATURES: balsa construction with iron-on film covering; includes a painted fiberglass cowl with dummy transparent cowl to assist in engine installation; retracts and flaps come installed; kit includes all of the necessary hardware plus spinner, fuel tank, wheels and a pilot.

COMMENTS: this is a great-looking airplane that goes together easily. Its light wing loading makes it a delight to fly.

HITS

- Excellent flight performance.
- Good overall appearance.
- High-quality, painted, one-piece fiberglass cowl.
- Pre-installed retracts and flaps.
- All hardware included.

MISSES

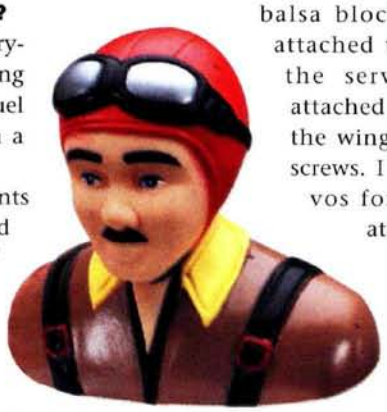
- Balsa mounting blocks for aileron servos.

The World Models Mfg. Chipmunk comes with everything you see here. Simply add a radio, engine, propeller and fuel tubing, and you're ready to get in the air.

WHAT'S IN THE BOX?

This plane comes with everything you'll need to get flying except the radio, engine, fuel tubing and propeller. Even a pilot figure is included!

As I examined the contents of the box, I was impressed by the excellent quality of materials and workmanship that went into this model. It is constructed mainly of balsa with a fully sheeted fuselage covered with iron-on film. There were a few wrinkles in the covering, but these were easily removed with a heat gun. The one-piece cowl is made of fiberglass and has been painted to match the covering. The paint job on the cowl was good, but the color was a little off.



The inclusion of a pilot figure with the Chipmunk is a really nice touch!

The wing is built up of balsa and partially sheeted. Flaps, ailerons and retracts come already installed. The stab and fin are pre-assembled balsa frames, while the elevator and rudder are solid ¼-inch sheet balsa. All are expertly covered. All control surfaces have been hinged with almost no gaps. A transparent dummy cowl, fuel tank, pre-installed retracts, foam tires, tailwheel, engine mount, spinner, pushrods, molded canopy, pilot, decals and a complete hardware package (with metric nuts and bolts) round out the package.

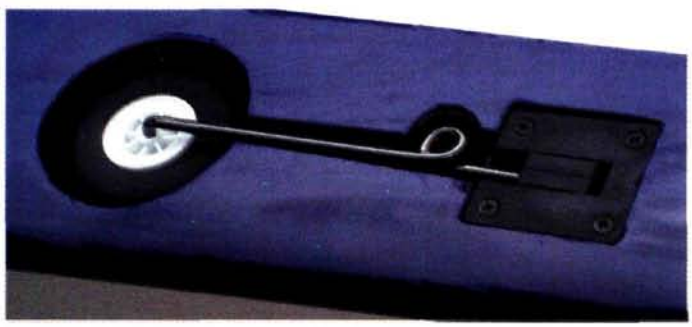
An 11-page instruction booklet guides you through assembly, so you won't need a full-size plan. The 26 assembly steps are depicted by a lot of drawings and symbols but very few words.

WING ASSEMBLY

Before I started the assembly, I removed one retract to ensure that the mounting plate was adequately reinforced. Noting that it was well braced, I proceeded with the wing. The wing comes in halves and requires two servos for the ailerons. The Chipmunk comes with two balsa blocks to mount the servos, but because balsa tends to be too soft to securely hold the servos in place, I replaced the balsa blocks with hardwood. I attached two wooden blocks to the servo covers and then attached the entire assembly to the wing with four small wood screws. I used Futaba S3003 servos for the ailerons. I then attached the aileron servo horns to the ailerons with the hardware provided. A piece of monofilament is factory installed in each wing half so the servo leads can be easily routed through the wing ribs to the center. Nice touch!

I used 30-minute epoxy on the root ribs and on the wing joiner to join the wing halves. The wing joiner fit snugly into the provided slots in the wing. Once the epoxy had cured, I completed the wing by installing the servos and pushrods for the flaps and retracts. I used a Futaba FP-S38 servo for the flaps and a Futaba FP-S136G servo for the retracts. The holes for the bolts that hold the wing down come predrilled in the wing halves, and the blind nuts are already installed in the fuselage. I had to slightly enlarge the holes to get the bolts to line up.

I jumped ahead in the instructions and attached the wing to the fuselage before installing the tail feathers. I figured if things didn't line up, it would be a lot easier to adjust the tail feathers than the wing. As it turned out, it really didn't matter; when I installed the tail feathers, they lined up perfectly without any cutting or shimming.



The retracts come already installed in the wing. This is a real timesaver. You simply have to install the servo and connect the pushrod.

ENGINE INSTALLATION

Next, I assembled and installed the fuel tank and fittings. Both were easy tasks. The tank provides a third hole for three-line filling; if you use a two-line system, be sure to plug the third hole.

This Magnum .91 engine provides the Chipmunk with a great deal of power; the plane practically leaps into the air.

The firewall is offset to provide right thrust, and the blind nuts for the engine-mounting bolts are already in place. I drilled through the fuselage sides and into the firewall and glued in six ⅛-inch dowels to reinforce the firewall. I then installed the adjustable engine mount and engine with the hardware provided. I used a Magnum FS-91AR 4-stroke engine mounted inverted. I replaced the plastic spinner included in the kit with a 2¼-inch Tru-Turn aluminum spinner.

COWL

A nice feature of The World Models ARFs is that the factory always includes a transparent dummy cowl, which you temporarily attach to the fuselage so you can see exactly where to mark the various cutouts. You then remove the dummy, make the cutouts in the dummy and, when you're certain they're all in the right places, put the

A nice feature of The World Models' ARFs is that they all come with a transparent dummy cowl. Temporarily attaching this to the fuselage allows you to see exactly where you need to mark the locations of the various cutouts.

clear dummy over the painted cowl and transfer the cutout locations. This is really slick! After I made all the cutouts, I attached the cowl with four sheet-metal screws.

PUSHRODS

The sheath for the solid wire rudder pushrod was already installed. I inserted the wire in the sheath to locate the pushrod cutout in the rear of the fuselage. I then made the elevator pushrod using the provided dowels and wire. The elevator pushrod has two threaded wires at the elevator end (one for each elevator half) and is a little difficult to install. Here's how I did it: I bent the wires to the approximate angle and then placed a rubber band about an inch from the end to hold them about ½ inch apart. I then inserted the pushrod into the fuselage and fed one of the wires through one of the slots at the rear of the fuselage. Next, I placed a brass tube over the protruding end, cut the rubber band and slid the brass tube further onto the first wire to keep it from snapping back into the fuselage. This released the other wire and permitted me to feed it through the slot on the other side of the fuselage. The brass tube held the first wire in line while I inserted the second through its slot. I then removed the brass tube and attached the clevises.

RADIO INSTALLATION

I put three standard Futaba S3003 servos in the factory-installed servo tray for the elevator, rudder and throttle, and I hooked up the pushrods. The kit comes with all of the necessary hardware, but since I never use EZ connectors on primary controls, I did not use the ones provided to attach the rudder and elevator rods to the servo arms. Instead, I used L-bends with snapper-keepers.

Next, I placed a Futaba FP-R129DP, 9-channel PCM receiver and battery in their respective cutouts in the provided foam-rubber block and placed the block in the front of the servo tray. The center of gravity turned out to be a little more than 4 inches behind the leading edge of the wing—exactly as the instructions recommended. I then installed the included pilot figure and attached the canopy with four small screws.

The final step was to apply the decals. The instructions don't cover this, but the decals' placement is clearly shown on the box. When it was completely decorated, the plane's identity couldn't be mistaken. I couldn't wait to get my latest Chipmunk into the air!

CONCLUSION

I found the Super Chipmunk to be a well-made ARF that went together easily and had a very neat appearance when completed. It is manufactured with precision and includes some well-thought-out features that make it a pleasure to build. If you want to get into the air quickly with a great-looking aerobatic airplane, then you may want to give The World Models Mfg. Co.'s Super Chipmunk a try.

***AirBorne Models**, 2127-H South Vasco Rd., Livermore, CA 94550; (925) 371-0922; fax (925) 371-0923; www.airborne-models.com; www.theworldmodels.com.*

***APC Props**; distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

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***The World Models Mfg. Co. Ltd.**; distributed in the USA by AirBorne Models.*

***Tru-Turn**; distributed by Romco Mfg., P.O. Box 836, South Houston, TX 77587; (713) 943-1867; fax (713) 943-7630; www.tru-turn.com.*

Fast-building, fast-flying Thompson Trophy racer

Kyosho Gee Bee Z .40 ARF

by Rick Bell

The Gee Bee Z won the 1931 Shell Speed Dash with an average speed of 267mph—then the fastest recorded speed for a land plane. The Z also won the Goodyear Trophy race with an average speed of 206mph. Kyosho has brought back the Golden Age of air racing with its Super Quality Series Gee Bee Model Z .40 ARF.

WHAT'S IN THE BOX?

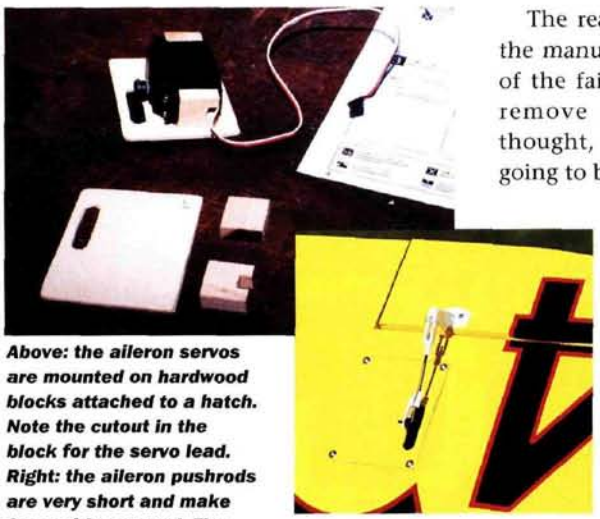
When you first open the box, you'll immediately be struck by the kit's quality. This sharp-looking, .40-size, almost-ready-to-fly (ARF) racer features a lightweight fiberglass fuselage and cowl that are painted in the famous Gee Bee paint scheme. The wings and horizontal stabilizer are built up from balsa and are sheeted. They are covered in a matching heat-shrink film. The characteristic wheel pants are made of fiberglass and are also painted. Also included in the kit are lightweight wheels, a fuel tank, a complete hardware package, a dummy radial engine and decals. The fuselage has stringer detail molded in to give the appearance of a fabric-covered structure. All that's needed to complete the Gee Bee is a 4-channel radio with 5 servos and a .46 2-stroke or .50 4-stroke engine.

The Gee Bee Z is a very complete kit. The lightweight, painted fiberglass fuselage is a work of art.

PHOTOS BY RICK BELL & WALTER SIDAS

WING CONSTRUCTION

Construction starts with the wing. I used the supplied CA hinges to attach the ailerons with thin CA. The aileron servos are mounted to hatches that you screw to pre-installed mounts in the wing; you will need two aileron extensions for the servo leads. With the aileron servos mounted, I assembled the aileron pushrods and screwed the control horns to the ailerons. I epoxied the wing halves together using the one-piece dihedral brace; the fit of the wing halves and brace was perfect. When the epoxy cured, I glued the lite-ply wing-bolt reinforcement plate to the bottom of the wing and then drilled the bolt holes through it. The wing was complete except for the landing gear.



Above: the aileron servos are mounted on hardwood blocks attached to a hatch. Note the cutout in the block for the servo lead. Right: the aileron pushrods are very short and make for positive control. The supplied hardware is of good quality for the intended job.

SPECIFICATIONS

MODEL: Gee Bee Z

MANUFACTURER: Kyosho

DISTRIBUTED BY: Great Planes Model Distributors Co.

TYPE: sport-scale ARF

WINGSPAN: 56½ in.

WING AREA: 511.6 sq. in.

LENGTH: 36 in.

WEIGHT: 5 lb., 14 oz.

WING LOADING: 26.46 oz./sq. ft.

RADIO REQ'D: 4-channel with 5 servos

RADIO USED: Futaba 9Z computer radio and a Futaba R128DF receiver w/four S3001 servos (ailerons, elevator and throttle) and one Futaba S9303 servo (rudder)

ENGINE REQ'D: .40 to .46 2-stroke, .50 to .53 4-stroke

ENGINE USED: O.S. .46 FX 2-stroke

PROPELLER USED: APC 11x6

FUEL USED: Morgan Cool Power 15%

LIST PRICE: $249.99

FEATURES: painted lightweight fiberglass fuselage, cowl and wheel pants; built-up balsa wings and stabilizer covered in matching heat-shrink film; comes with hinges, wheels, adjustable engine mount, fuel tank, decals and hardware.

COMMENTS: the Kyosho Gee Bee Z is a fine sport-scale ARF model of a Golden Age racer. Its quality is way above average, and the glass work is just superb. It's easy to build, and I really enjoy flying this racing airplane. It's always the center of attention at my local flying field!

HITS

- High-quality fiberglass parts and construction.
- Easy to assemble.
- Flies well.
- Great scale appearance.

MISSES

- Landing-gear instructions could be clearer.

LANDING GEAR

Next, mount the torsion-wire landing gear and the three-piece wheel pants. Following the instructions, I installed the wire gear followed by the front fairing, into which you must cut reliefs to allow the gear to flex. The gear-retaining straps are screwed into place next. Make sure you install the straps right next to the fairing and that the inboard strap is installed as close as possible to the gear leg. Now drill a hole in the wheel pants for the axles, and install the pants on the wire gear and into the fairing. The instructions recommend using silicone to attach the pants to the wire gear; instead, I used a retaining strap on the upper part of the pant and a wheel collar on the inside of the pant to secure it in place. This allows you to remove the wheel pants in case repairs are needed.

The wheel pants have a groove molded in for the wire gear leg. To facilitate future removal, I used landing-gear straps and an extra wheel collar on the axle to hold them in place.

The rear fairing is mounted next, and the manual suggests that a major portion of the fairing be cut away and that you remove the fairing before flight. I thought, "Why cut up the fairing if it's going to be removed for flight?" and left it as it was. After I installed the fairing, I noticed that when the gear flexed back and forth, the rear of the pant slid into the rear fairing, so I left the fairing on for flight, and I'm happy to say that I've had no problems to date. I think the looks of the Gee Bee are much improved with all of the wheel-pant parts in place.

WING MOUNTING AND FAIRING

Next, I mounted the wing on the fuselage. To get a good fit, the tongue on the wing and the mating slot in the fuselage needed some minor trimming. The instructions suggest using silicone or thin saddle tape to seal the wing to the fuselage joint; I used silicone. Next, I attached the fiberglass lower wing fairing but instead of epoxying it into place as recommended, I screwed the fairing to the wing's leading edge and used a few drops of thick CA to tack the fairing to the wing's trailing edge. I did this to make removing the fairing easy in case any repairs were ever needed. Remember the landing-gear straps? Now you can see that if they are not properly spaced, they will interfere with the wing fairing, which would have to be cut up to fit properly. You can guess how I found this out.

TAIL FEATHERS

Next, I mounted the stabilizer on the fuselage, and I needed to open the slot in the fuselage slightly to allow the stabilizer to easily slide in. You also need to cut a slot in the stabilizer's trailing edge for the elevator-joiner wire. When I was satisfied with the stabilizer fit, I epoxied it into the fuselage and when it had cured, I hinged the elevators using the supplied CA hinges. I also epoxied the joiner wire to the elevators.

I next hinged the rudder and installed the tailwheel assembly. Again, you'll need to cut a slot in the rear of the fuselage and drill a hole in the rudder for the tailwheel assembly.

ENGINE INSTALLATION AND COWL

With the Gee Bee's big cowl, engine installation is a snap. You could mount a 2-stroke engine upright without its head sticking through the cowl, but you'd have to cut

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

The O.S. .46 FX was a well-broken-in, great-running engine, so only minor adjustments were needed for the new installation. I was concerned about the short-coupled fuselage and landing gear during taxi and takeoff, but it didn't nose over—even on thick grass runways! When you advance the throttle, the Gee Bee moves out quickly; however, until sufficient airspeed is reached, you need to be ready to work the rudder. Takeoff roll is not difficult; it just requires good rudder management. Once up to speed, the Gee Bee tracks very well and lifts off with just a touch of up-elevator. The Gee Bee flies like a good sport airplane! Landings are easy; do a standard approach, line it up on final and, using throttle, guide the Gee Bee in. Wheeled landings were easy to do and looked great on rollout!

LOW-SPEED PERFORMANCE

The Gee Bee maintains very good control at low speed, although I felt that a little more elevator was needed. Stalls hold no surprises; they are gentle, and no snapping was noted.

HIGH-SPEED PERFORMANCE

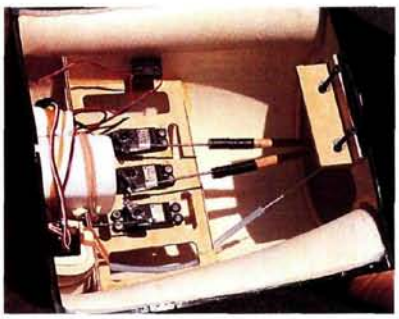
The Gee Bee moves out quickly and tracks very well. No trim changes are needed between low and high speeds. The recommended control throws make for a solid feel at high speed. It was a lot of fun pretending to run a pylon course!

AEROBATICS

Can you say "Neat!"? The Gee Bee is a real sleeper! Its flight manners are very refined; if you can fly a low-wing sport plane, you can handle the Gee Bee. The Gee Bee is capable of all aerobatics. Loops track well, rolls are very axial, and it's a real hoot to watch the wings rotate around that big, round fuselage. Knife-edge flight is easy and well mannered, as are point rolls. All in all, the Gee Bee is a exciting airplane to fly. I can just see two or three of them running a pylon race!

away part of the fuselage and glue a tunnel into place to accommodate the muffler. With the cowl in place, this would hardly be noticeable. But I wanted to preserve the lines of the cowl as much as I could, so I side-mounted an O.S. 46 FX and used a Slimline Pitts-style muffler (no. 3218). By using the Slimline muffler, I needed only to cut an opening in the bottom of the cowl for the exhaust to exit.

The firewall has molded-in reference lines to help you install the engine mount either upright or sideways. Using the lines as a guide, I attached the mount with the supplied hardware and installed the motor the recommended distance from the firewall. Next, I fuelproofed the cowl-attachment ring and screwed it to the firewall. I glued the cowl-mounting blocks to the ring, mounted the cowl and fit the dummy radial engine. After making the required cutouts in the dummy, I glued it into the cowl using silicone. The Gee Bee was now ready for radio installation, final assembly and set up.



The plywood trays come glued into the fuselage for fast assembly. Because of the short nose moment, I mounted the battery and receiver as far forward as possible; I had to add 3½ ounces of weight to the nose. The battery is secured to the fuel tank with rubber bands.

There's plenty of room for the engine. I side-mounted the O.S. .46 FX and used a Slimline Pitts-style muffler to exit the exhaust out the bottom of the cowl. The cowl is screwed to the plywood ring; be sure to fuelproof it.

The supplied dummy radial engine adds a lot of character to the model. It's vacuum-formed and takes only a few minutes to fit into the cowl. I used silicone to glue it in.

FINAL DETAILS

Radio installation was a snap; there is abundant space in the fuselage for any radio equipment. I mounted the servos, made up the pushrods and attached them to the control surfaces. Because of the short nose moment, I used rubber bands to mount the receiver battery on the fuel tank as far forward as possible. I then trimmed and fitted the canopy, and the Gee Bee was ready to be balanced. I used a Great Planes CG Machine to do this; the Gee Bee required 3½ ounces of weight in the nose to make it slightly nose heavy. If you use a 4-stroke engine, most (if not all) of the nose weight can be eliminated.

I next set up the control throws as recommended, applied the decals, made a final check of the airframe and double-checked the radio system.

FINAL THOUGHTS

The Kyosho Super Quality Series Gee Bee Model Z is a great-looking model that requires little effort to assemble. I built mine in a few days and was amazed at the results. I used all of the supplied hardware, and I was pleased with its fine quality. The Gee Bee's flight qualities are very good; wherever it goes, it draws many favorable comments. What a way to start your own Thompson Trophy races! ✈

APC Props; distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.

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Great Planes Model Mfg. Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 637-7660; www.greatplanes.com.

Kyosho; distributed by Great Planes Model Distributors, www.kyosho.com.

Morgan Fuel, P.O. Box 1201, Enterprise, AL 36331; (800) 633-7556; (334) 347-3525; fax (334) 393-4852; www.morganfuel.com.

O.S.; distributed by Great Planes Model Distributors Co., www.osengines.com.

Slimline Mfg., P.O. Box 3295, Scottsdale, AZ 85257; (480) 967-5053; fax (480) 967-5030; www.slimlineproduts.com.

Super Kraft Staudacher GS-300 ARF

by Craig Trachten

Most of us will probably never experience the thrill of a ride in an aerobatic aircraft, but taking the sticks of the Super Kraft Staudacher GS-300 just may be the next best thing; it's a .60-size dream machine. The craftsmanship and quality of the materials can't be beat. The pleasure of building this aircraft can only be surpassed by the thrill of flying it.

Super Kraft's Staudacher GS-300 comes with everything you see here. The quality of the materials is excellent.

WHAT'S IN THE BOX?

Super Kraft's almost-ready-to-fly (ARF) Staudacher is constructed entirely of balsa and covered with UltraCote. It comes with nearly everything you'll need to get it into the air: a painted fiberglass

.60-size amazing aerobat

SPECIFICATIONS

MODEL: Staudacher GS-300 ARF

MANUFACTURER: Super Kraft

TYPE: sport scale

LENGTH: 48½ in.

WINGSPAN: 60 in.

WING AREA: 690 sq. in.

WEIGHT: 119 oz.

WING LOADING: 24.85 oz./sq. ft.

ENGINE REQ'D: .61 to .75 2-stroke or .91 4-stroke

ENGINE USED: MDS .78 2-stroke w/Bisson Custom Mufflers' Pitts Style no. PN00160

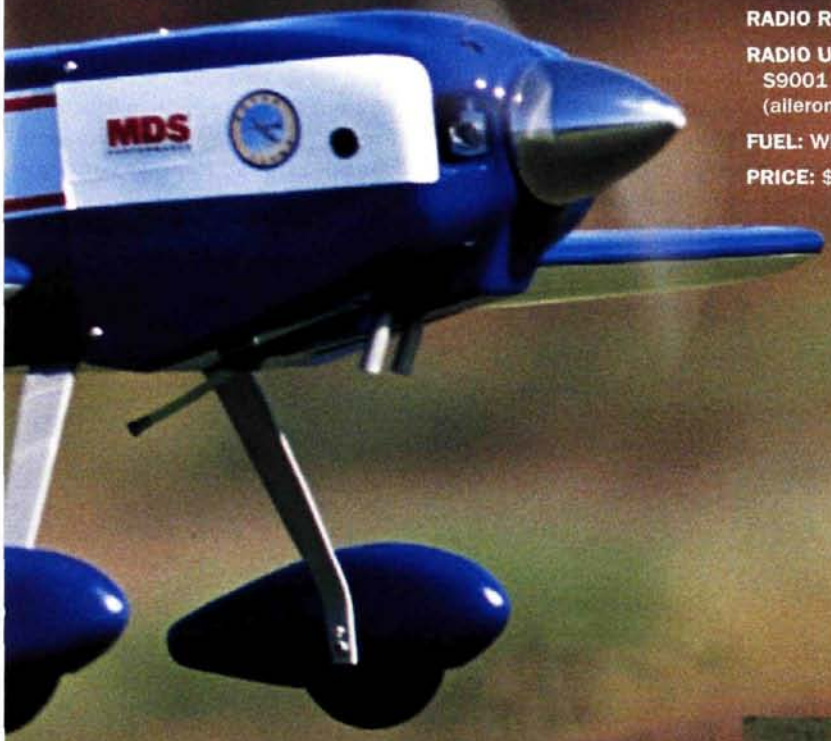
PROP: APC 12x6

RADIO REQ'D: 4-channel w/5 servos

RADIO USED: Futaba 8UAF w/one S9151 digital servo (elevator), one S9001 servo (rudder), one S3001 servo (throttle) and two S148 servos (ailerons)

FUEL: Wildcat 2- and 4-cycle 15% nitro

PRICE: $237.77



FEATURES: all-wood construction covered with UltraCote; one-piece fiberglass cowl; aluminum motor mount and landing gear; included clear canopy and wheel pants.

COMMENTS: Super Kraft's Staudacher GS-300 is a high-quality aircraft that goes together quickly and easily. The best thing about this plane is flying it!

HITS

- Well constructed.
- Wheel pants can be easily enlarged for bigger wheels.
- Excellent instruction manual.

MISSES

- Weak steering-arm link.

cowl, ABS wheel pants, aluminum landing gear, a motor mount, a fuel tank, wheels, a canopy, decals, a main wing brace, a detailed instruction manual and all of the necessary hardware.

ASSEMBLY

As with most ARFs, construction begins with the wing. First, be sure to pull the factory-installed servo-wire pull strings up through the wing before you epoxy the wing halves together. Test-fit the center brace and make sure that it bottoms out

on each side with the straight edge facing up. At this point, I usually wrap a ¾-inch piece of masking tape around each wing root. Epoxy the wing halves together and set them aside to dry. When the wing has dried, removing the tape will also remove any excess epoxy. Pegs on the wing's trailing edge ensure proper alignment.

It's a good idea to start the stabilizer installation while the wing is drying. Measure and mark a centerline on the horizontal stab, and mark a vertical centerline on the firewall. Slide the stab through the fuselage until the centerline can be seen through the vertical stab slot, making sure you center it. The distances between the centerline on the firewall and the tip of each side of the stab should be equal. Mark where the fuselage meets the stab, and remove the covering on the stab within these lines. Check for proper alignment, and epoxy the stab into place. Attach the vertical stabilizer in the same manner: test-fit, check alignment, remove the covering and epoxy into place. I applied a healthy amount of epoxy to the sides of the fin slot so that when I inserted the fin, it forced the epoxy down, so it bonded the fuselage, horizontal stab and vertical stab into a single unit.

The factory-installed servo-wire pull strings ease assembly. Be sure to pull them through the wing before you epoxy the halves together.

The next step is to install the radio tray and pushrods. Temporarily mount your engine on the fuselage so that you can locate and drill the hole for the throttle pushrod; then test-fit your servos in the servo-mounting tray. I found the servo openings small, so I used a hobby knife to enlarge them. Don't mount the servos on the tray at this time.

Test-fit the servo tray in the fuselage and epoxy it into place. The dowel and wire pushrods supplied with the kit will work fine, but I prefer to use Dave Brown's fiberglass pushrods. They are strong and easy to build, especially if the model requires a pickle-fork elevator pushrod as this one does. I find that inserting a pushrod chase from the tail to the radio compartment is the easiest way to feed the pushrods through the fuselage. Simply insert the pushrod wire into the chase and push. With this method, they're fed through the fuselage without being hung up on a bulkhead. Last, attach the servos to the tray.

The instructions recommend a three-line fuel tank instead of a filler valve—something I don't ever remember seeing before. I always use a three-line system when the aircraft has a cowl. Although it isn't mentioned in the manual, I always clunk my third line; it makes fuel removal easier and more efficient. I also always use different-color tubing for each of the fuel lines.

FLIGHT PERFORMANCE

Before the first flight, I ran the standard equipment and radio checks. When I was sure everything was in working order, I added some Wildcat 15-percent nitro fuel and was ready for takeoff.

TAKEOFF AND LANDING

As I slowly added throttle, the Staudacher tracked straight down the runway, with no bad handling tendencies on the ground. At about ¾ throttle, I added a little up-elevator and the plane took off. At altitude, it required some elevator and aileron/rudder inputs for straight and level flight.

On landing, maintain some power but slow the model down enough so you don't overshoot your landings. I found that an APC 13x8 prop didn't allow the model to slow down enough; I switched to an APC 12x6 and was able to get the model on the ground with no problems.

LOW-SPEED PERFORMANCE

I was surprised by this aircraft's low-speed characteristics. I was expecting a severe dip in the wing when I stalled it, and although the left wing did drop considerably, it was not violent. I added more power and a bit of up-elevator, and the plane quickly returned to straight and level flight. I even accidentally ran out of fuel, and the plane went deadstick on the upwind leg of the approach. Keeping her on a slight nose-down attitude, I turned onto base and into the final approach without incident. I greased the landing and rolled to a midfield stop. The Staudacher's stability and penetration at deadstick surprised everyone—most of all, me.

HIGH-SPEED PERFORMANCE

The airplane is in its element at high speeds. While it was still on the ground, I punched full throttle and pulled some up-elevator, and it went vertical. At the specified control throws, I was unable to cause high-speed stalls. Because the aircraft was a bit too responsive for the style of flying I enjoy, I added 25 percent exponential and 70 percent dual rate on my control surfaces. I set the dual rates on high for takeoff and landing.

AEROBATICS

This is what the Staudacher is all about. Rolls, loops, knife-edge, inverted flight; this plane handled them all with ease. The first time I flew it, these maneuvers required various control inputs, but by following the instructions in the "advanced flight trim" section of the manual, I ended up with an aircraft that knocked my socks off, and it will knock yours off, too!

Cross up the lines just once, and you'll know why!

Wheels are good things, so let's install them next. The tailwheel and mounting bracket are one piece, and three wood screws secure the bracket to the fuselage. Temporarily install the rudder and mark and cut the slot for the steering-arm link. This link is somewhat weak; it broke on the first rough landing. I repaired it by bending a 90-degree angle about ½ inch long in the tailwheel wire; then I drilled a hole in the rudder and inserted the bent wire directly into it. I suggest you do it this way the first time. The main wheels are easy to install: just bolt them into place with the supplied hardware. Because I fly off grass, I opted to install Du-Bro 350T, 3½-inch wheels. To accommodate the larger wheels, I enlarged the opening in the wheel pants with a sanding drum.

Epoxy in the elevators and rudder, but don't get epoxy on the hinge joint. You can use petroleum jelly as indicated in the manual, but I find it a little messy. I bent the hinge, applied light oil through a needle-point oiler, worked the hinge and then wiped the "ears" with an alcohol wipe before I epoxied it into place. Either way, make sure your control surfaces move freely.

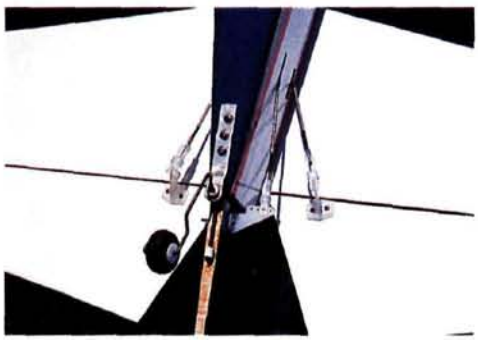
The instructions call for the use of RTV silicone to install the fuel tank, but this makes it difficult to remove the tank if a problem arises. I chose to slide the tank into place and then stuff foam rubber between the four sides and the fuselage. I then cut a craft stick to size and CA'd it across the back of the tank between the side walls. The foam prevents the fuel tank from moving, and the craft stick secures the tank to the firewall. Repairs can easily be made by cracking out the craft stick and sliding out the tank.

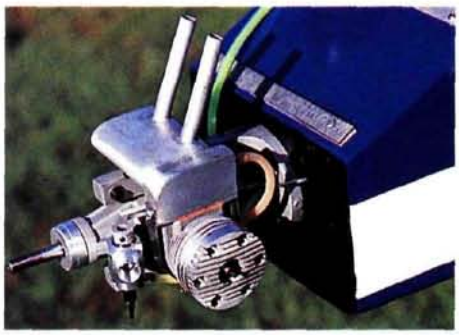
Everyone has his own method of installing pushrods, especially the pickle-fork elevator rod. I find it easiest to slide pushrod chases from the tail into the radio compartment. I insert the ends of the pickle fork into the chases and then push. The pushrod slides through the fuselage without getting hung up on a bulkhead. The rudder rod installation is straightforward. The instructions call for the use of Z-bends to attach the rods to the servo arms, but I much prefer to use L-bends and pushrod keepers.

Install the engine mount on the firewall using the supplied screws, and don't forget the thread-lock. Attach the engine of your choice to the mount. If you use a Z-bend at the throttle-arm end of the pushrod, install the Z-bend in the arm, slide the pushrod into the chase and then bolt down your engine. I installed an MDS Pro .78. I wanted a clean, scale look, so I used Bisson's strap-on Pitts-style muffler to keep the muffler under the cowl. I attached the throttle linkage using a ball in the arm and a ball cup on the pushrod. The rod required multiple bends to make its way from the firewall to the carburetor, but the ball and cup configuration eliminated stress on the rod caused by all the bends.

The cowl installation is my least favorite part of a construction process; it isn't difficult—just tedious. A neat, clean fit requires a great deal of trial and error, but the result is worth it. Don't forget to allow for spinner clearance before you secure the cowl to the fuselage.

Final assembly consists of canopy application and balancing. A pilot bust is a nice touch to add before you attach the canopy. I used a Hangar 9 scale sport figure. Balance the aircraft as instructed; err on the nose-heavy side, if necessary. After flying the aircraft, you can make any minor center-of-gravity changes needed. ✈





Left: the steering-arm link provided with the kit broke on the first rough landing. I repaired it by inserting the tailwheel wire directly into the rudder, as shown here. Right: a close-up of the MDS Pro .78 engine. Following the instructions, I used a three-line fuel system. Note the green filler line. Using colors to distinguish the lines prevents confusion.

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Wildcat Fuels, *3005 Park Central, Unit T, Nicholasville, KY 40356; (606) 885-5619; www.wildcatfuel.com.*

FLIGHT TEST

The next generation of helis has landed

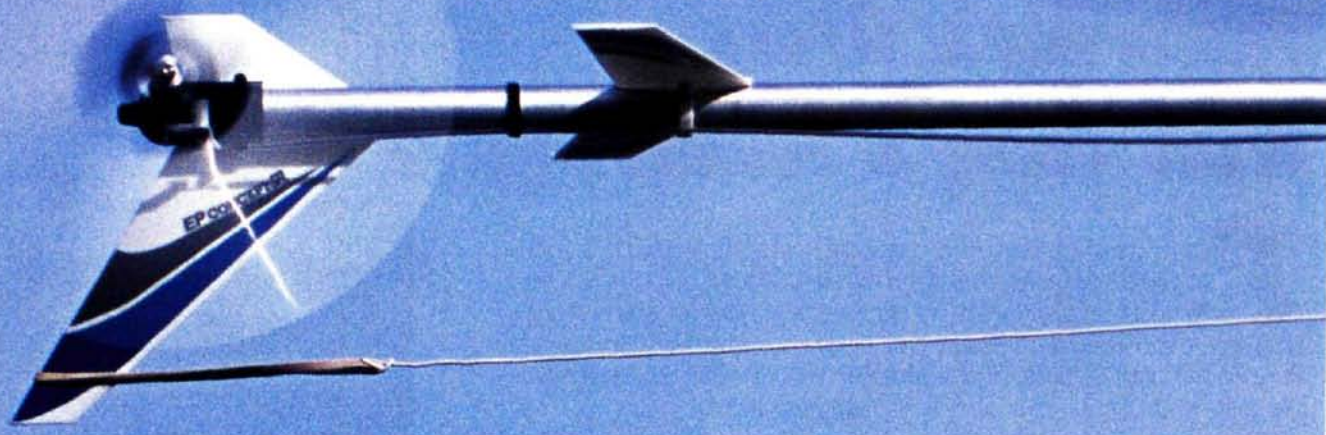
Kyosho EP Concept SR

by Rick Bell

When I was at a helicopter contest several years ago, someone demonstrated an electric helicopter, and I was very impressed by its performance: stall turns and rolls but no engine noise or fuel mess. It was the Kyosho EP Concept, which has since been improved and is now offered as the "SR." Improvements include a "see-saw" main rotor-head design and a taller main shaft that eliminates the chance of boom strikes. Its more powerful S-Power electric motor delivers more torque and longer flight times than the previous 540 K Speed motor.

KIT CONTENTS

The model comes pretty much assembled: the chassis with the motor and gearing, the tail boom and the tail drive have already been built. The same is true of the main rotor head, including the flybar assembly; it has only to be balanced. The canopy is molded of virtually indestructible polypropylene. All the pushrods and a colorful decal sheet are included. There are two building manuals and a supplemental sheet that gives information and maintenance tips on the S-Power motor. One manual covers the assembly of the ARF version, and the other is the full construction manual with the required setup information. To get airborne, you need only to supply a heli radio system with four servos of standard size, a 20A electronic speed control, a small gyro (I recommend a mini piezo gyro) and a 7- or 8-cell 2000mAh battery.



FLIGHT PERFORMANCE

• HOVER CHARACTERISTICS

When I was satisfied that everything was working properly, I slowly advanced the throttle and brought the blades up to speed, but I kept the heli on the ground for a few minutes to let the gears wear in. I then advanced the throttle to exactly ½ stick, and the heli was sitting in a solid hover. It needed some minor blade-tracking adjustments and tail-rotor trim. The head speed was a little low, so I adjusted it with the throttle curve.

The controls felt good—solid and not twitchy (as small helicopters tend to be). Tail-rotor response was good, but the gyro gain was too high and had to be turned down; the pirouette rate was too slow for my liking. After I had made these minor adjustments, I was soon flying low-level circuits, circles and figure-8s. The first flight lasted about 4½ minutes—not too bad. Because I had several charged battery packs, I flew several times and always managed 4 to 5 minutes. It's a lot of fun to be able to go out into my front yard and grab some stick time whenever I want to.

• GENERAL FLYING

The Concept is well behaved both in slow and fast forward flight. The motor has good pulling power, and full-power climb-outs were brisk. The Futaba speed controller performed well—very important to us heli guys! I did have a slight tracking problem, and it's probably the result of the lightness and flexibility of the foam blades; I plan to try different blades later on.

I have flown the Concept many times and have done stall turns, 540 stall turns, loops and rolls, which really took finesse. I didn't try inverted flight because the pitch range setup wasn't adequate to sustain any prolonged inverted forays.

I think the Concept has a lot of potential; a brushless motor, different blades and an aerobatic pitch curve would enhance an already great model. In stock form, the EP Concept SR is a delight.

SPECIFICATIONS

MODEL: EP Concept SR

TYPE: electric helicopter

MANUFACTURER: Kyosho

DISTRIBUTOR: Great Planes Model Distributors Co.

WEIGHT: 3.4 lb.

MAIN ROTOR DIAMETER: 35.2 in.

LENGTH: 32.3 in.

MOTOR: Kyosho 14-turn S-Power (included)

RADIO USED: Futaba 9ZH (with 4 S3001 servos), MC114H ESC and GY240 piezo gyro

BATTERY USED: 7-cell, 2000mAh

STREET PRICE: $379.99

FEATURES: lightweight carbon-fiber-reinforced frame; assembled chassis; gear train; tail boom and main rotor head; belt-drive tail rotor; seesaw-design main rotor head; long main mast; 14-turn motor; balanced foam-core main rotor blades; one-way bearing for autorotations.

COMMENTS: the Kyosho EP Concept SR with seesaw head is a fun, quiet heli that requires little assembly. Its flight is smooth and predictable, and because it's electric, you can fly it indoors. Outdoor flights are comparable to those of a .30 heli, and the new seesaw head design gives it a balanced feel.

HITS

- Many components already assembled.
- Straightforward to build.
- Easy-to-follow manual.
- Well-matched power system.
- Good flight qualities.

MISSES

- Ball links too tight.

AT THE WORKBENCH

Because all of the EP's major assemblies arrive built, there's very little left for you to complete. To complete the airframe, fit the landing gear, the main rotor head and main blades and the tail-rotor assembly.

First, I installed the landing gear so I'd have a stable platform to work from, and I suggest that you do the same. Screw the prebent wire legs and the battery-retainer clips to the underside of the fuselage; the skids simply snap onto the legs. Following the manual, I added the decals to the tail fins and then installed the fins on the tail boom. Most polypropylene canopies are difficult to trim, but the Concept's proved to be an exception. I used a new no. 11 hobby blade, and in a few minutes, the canopy was ready for the decals, which are some of the best I've encountered; they can be stretched to conform to curved surfaces. The decal sheet includes four large "windshield" pieces that conformed to the canopy very well.

The Concept's tail rotor is very responsive. The blade grips are supported by two radial bearings that ensure smooth operation. Don't forget to use a thread-locking compound on the setscrew.

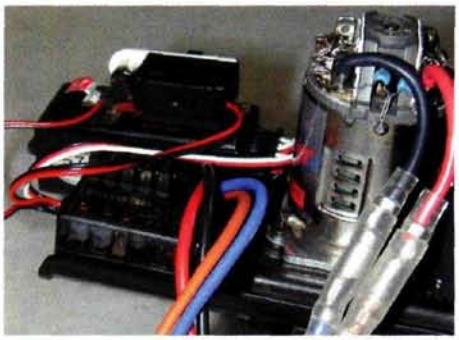
RADIO INSTALLATION AND SETUP

The airborne equipment is all by Futaba: four S3001 servos (one each for collective pitch, right/left cyclic, fore/aft cyclic and tail rotor); an FP-MC114H speed controller; and a GY240 AVCS piezo gyro (this tames the tail). An R148DP PCM receiver and a 9ZH transmitter tie everything together.

Having built the tail rotor, I balanced it on a Robart High-Point balancer (the manual doesn't mention this step) and then installed it on the output shaft along with the tail-rotor pushrod and servo. I made the pushrods to the lengths specified, attached them to the servos and mounted the servos on the chassis. The manual is very good here and doesn't leave any room for error; the pushrod lengths for each control are all specified. My only problem was with the ball links, which were very tight on the balls; I reamed every link with a ball-link sizing tool to obtain the proper fit.

Next, I assembled the linkages for the rotor head and then installed them on the head. The manual has you install the rotor head on the heli at this point, but I recommend that you wait until you have the speed controller hooked up and working. If

Installing the radio gear is easy; the manual tells you how. The motor and gear train arrive assembled. Note the switch harness; it comes with the ESC and has an arming button to protect against an accidental start-up.



There's plenty of room for the receiver and speed controller in the nose. If you want to save weight, use a smaller receiver.

INTRO TO HELI AEROBATICS

After you've learned to hover and then to fly your helicopter in forward flight, the natural progression is to try aerobatics. But how and where do you start?—just as you learn anything else: with the basics. The requirements for a heli to do aerobatics are very different from those of fixed-wing aircraft. Let's take a closer look.

FLIGHT MODES

If you hang around heli guys, you might hear them talk about flight in these terms: normal mode, idle-up 1, idle-up 2 and throttle hold. Just what are they talking about? Well, each flight mode has its own settings for the throttle and collective-pitch curves. A switch or switches on the radio usually activates a mode and chooses the settings that have been programmed in for the mode.

- Normal mode: usually set for hovering maneuvers.
- Throttle hold: sets the throttle at a slow idle so the clutch can disengage and allow the main rotor to spin freely; it is used for autorotations.
- Idle-ups are used for aerobatics; each includes settings for throttle and pitch curves as well as for other variables. An example of an idle-up setting: if you want to fly the model inverted, idle-up will increase throttle at a low stick position.

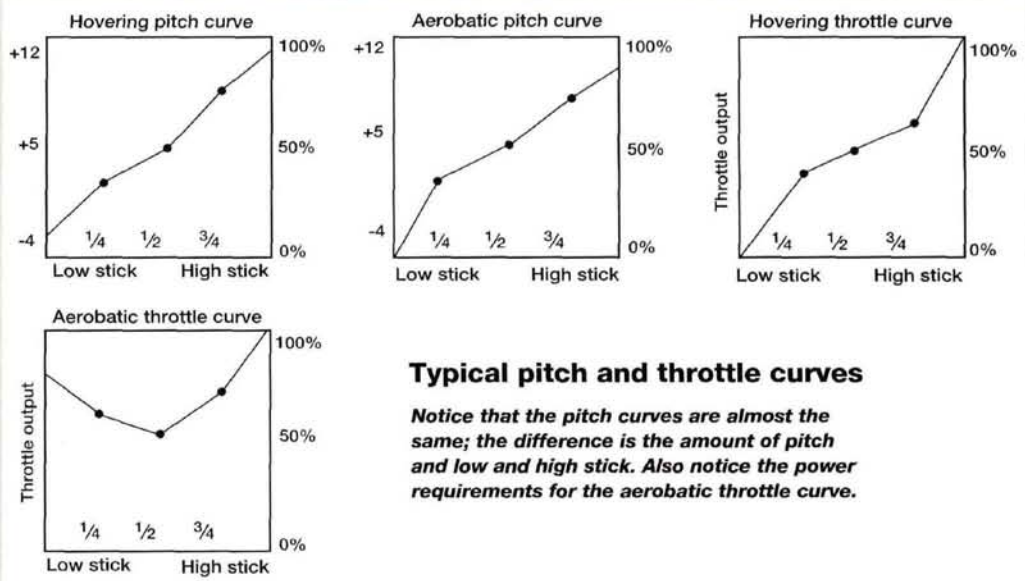
AEROBATIC SETUP

There are many ways to set up an RC heli and its radio to achieve the desired results. Needless to say, the more programming functions a radio has, the more you're able to refine its setup and the maneuvers it can do. But no matter which radio you use, all helicopter setups have one thing in common: they must first be set up mechanically, and then you use the radio to refine the parameters. You can't depend on the radio to compensate for a bad mechanical setup.

The collective pitch and throttle requirements for the flight modes vary, and factors such as available engine power and blade type (flat-bottom, symmetrical, etc.) come into play. Normal mode usually requires around ½ throttle and collective inputs, and throttle hold requires only a reliable idle; depending on the maneuver, idle-ups require the most precise matching of the throttle and pitch curves. The most important objective for each

Typical flight modes and their collective-pitch settings

Flight mode	Collective pitch		
	Low	Mid	High
Normal	-3	+5	+9
Idle-up 1	-5	+2	+9
Idle-up 2	-9	0	+9
Throttle hold	-6	+4	+12



Typical pitch and throttle curves

Notice that the pitch curves are almost the same; the difference is the amount of pitch and low and high stick. Also notice the power requirements for the aerobatic throttle curve.

The Futaba MC114H speed controller and GY240 gyro are light companions for any small electric heli. The ESC's many built-in features ensure reliable, trouble-free operation. Its response to throttle-stick inputs is very smooth; I couldn't detect any "steps" when going from low to high throttle settings. The GY240 gyro is very powerful for its size and is easy to install and set up. It features manual gain adjustments, a reversing switch and an on/off switch for heading-hold. It's ideal for any beginner: packed with performance and simple to use—great combination!

you have an accidental start-up, you might damage the heli and injure yourself. Remember: as soon as an electric motor sees current, it will run!

I finished the radio installation by adding the gyro and speed controller and then plugging the components into the receiver. For safety, I did not make the connections from the motor to the speed controller at this point. I set up the idle and high points on the speed controller by closely following the instructions that came with it, and this went without a hitch.

All that remained was the balancing of the rotor head and main blades; and I had to set up the control throws and directions. Again, the manual is very clear on the details, and you won't have any problems if you follow it closely. The main rotor pitch curve is easy to set using the supplied pitch gauge. Make sure the motor is not connected to the speed controller when you make these adjustments or the rotor will turn!

The Concept's main rotor comes fully assembled and ready to be balanced. The newly designed main rotor has a solid axle that goes through the yoke to support the blade grips. The ball links in my kit were too tight on the balls and had to be loosened.

Initial pitch settings:

- 8 degrees for hovering;
- 10 to 11 degrees on the high end;
- 0 to -2 degrees on the low end.

I found these numbers a good starting point.

After that, all I had to do was to slip the canopy on and put the battery into place. The battery is held by the lower rear edge of the canopy and a rubber band across the battery-retainer clips—a setup that makes it easy to adjust the heli's center of gravity.

Did I enjoy assembling and flying the EP Concept SR? I certainly did! Assembly was quick and easy; it took me about four hours from opening the box to being airborne. I definitely like the lack of noise with electrics; I can fly in my yard without disturbing the neighbors—a very big plus! The instruction manual is easy to follow, and the Concept SR's performance is good right out of the box. ✈

Futaba Corp. of America; *distributed by Great Planes; www.futaba-rc.com.*

Great Planes Model Distributors Co., *P.O. Box 9021; Champaign, IL 61826-9021; (800) 637-7660.*

Kyosho/Great Planes *(217) 398-6300; www.kyosho.com.*

Robart Mfg., *P.O. Box 1247, 625 N. 12th St., St. Charles, IL 60174; (630) 584-7616; fax (630) 584-3712; www.robart.com.*

mode (except throttle hold) is to maintain constant main-rotor rpm.

Most heli kits' assembly instructions provide the values needed for the various flight modes. I recommend that you use these as starting points; you can tweak them later as needed.

TAIL-ROTOR ADJUSTMENTS

During forward flight and aerobatics, the tail rotor is often overlooked. While hovering, a certain amount of tail-rotor pitch is needed to compensate for yaw, and less pitch is required during forward flight and aerobatics because of the stabilizing effect of the airflow over the horizontal and vertical fins.

Most heli radios have some sort of programmable tail-rotor compensation to keep the heli's nose pointing straight during climbs and descents. Properly setting up tail-rotor compensation for aerobatics is a science unto itself, and it would take several pages of this magazine to describe.

There is an easier way to achieve almost perfect tail control these days: the newest heading-hold gyros all but eliminate the need for programmable tail-rotor compensation; in fact, to use a gyro in heading-hold, you must turn off any tail-rotor programming, as any programming inputs will confuse the gyro. Head-lock gyros are also great to use with heli radios that don't have fancy tail-rotor mixing abilities.

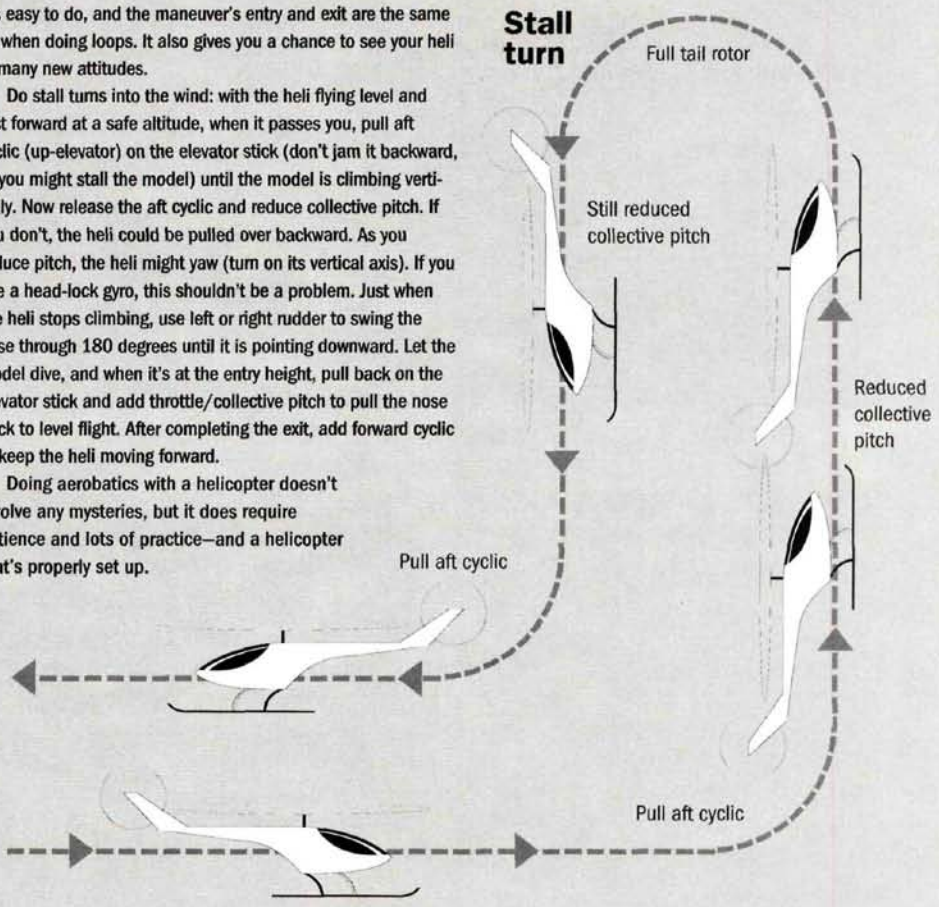
PUTTING IT TOGETHER

Before trying any aerobatics, you should be comfortable when flying your heli forward and especially with nose-in hovering (you're looking at the heli's nose). Aerobatics will place the heli in many positions and attitudes, so if you aren't comfortable doing nose-in, I recommend that you learn it before you begin aerobatics; you'll be glad you did.

First, learn to do a stall turn; this is a good place to start, as it's easy to do, and the maneuver's entry and exit are the same as when doing loops. It also gives you a chance to see your heli in many new attitudes.

Do stall turns into the wind: with the heli flying level and fast forward at a safe altitude, when it passes you, pull aft cyclic (up-elevator) on the elevator stick (don't jam it backward, or you might stall the model) until the model is climbing vertically. Now release the aft cyclic and reduce collective pitch. If you don't, the heli could be pulled over backward. As you reduce pitch, the heli might yaw (turn on its vertical axis). If you use a head-lock gyro, this shouldn't be a problem. Just when the heli stops climbing, use left or right rudder to swing the nose through 180 degrees until it is pointing downward. Let the model dive, and when it's at the entry height, pull back on the elevator stick and add throttle/collective pitch to pull the nose back to level flight. After completing the exit, add forward cyclic to keep the heli moving forward.

Doing aerobatics with a helicopter doesn't involve any mysteries, but it does require patience and lots of practice—and a helicopter that's properly set up.



Dymond Modelsports Tiger Moth ARF

Classic '30s biplane with performance.

by Gerry Yarrish

With its swept-back wings and distinctively shaped fin and rudder, the de Havilland DH-82a Tiger Moth is one of the most popular antique biplanes around. Used in both military and civilian aviation, the Tiger Moth was designed as a primary training aircraft. Countless models of this aircraft have been designed and built, and, now, Dymond Modelsports gives us a very easy to assemble, almost-ready-to-fly (ARF) version. Intended for .60 to .90 2-stroke and .90 to 1.20 4-stroke engines, the Dymond Tiger Moth is also very easy to fly. Let's take a closer look.

The Dymond Tiger Moth is available uncovered; covered in yellow and black or green and black plastic film; and with a paintable fabric finish. The cockpit area is a separate part and forms a slide-out hatch cover; it slides into place from the side and two screws within the cockpit openings hold the structure in place. It's very easy and convenient to check the radio and fuel tank while leaving the bottom wing in place.

The wings come in halves, and two aluminum joiner/dihedral braces provide strength. The model has four ailerons; the full-size aircraft had only two. You can fly the model with either two or four ailerons, but to use only two, you must tape the top ones into a fixed position. I used all four ailerons and made slave pushrods to connect the top and bottom control surfaces.

The tail surfaces are completely built and covered, and the fin has a tab that fits into a slot in the horizontal stabilizer. All the control surfaces, including the ailerons, come hinged and sealed with film covering. Also included in the kit are instructions; a fiberglass engine cowl; aluminum cabane and interplane struts; a formed and painted landing gear; a tailwheel assembly; wheels; fuel tank and basic nuts and bolts.

The Dymond Tiger Moth is a very complete kit; everything you'll need is here except an engine and radio gear.

SPECIFICATIONS

MANUFACTURER: Dymond Modelsports

MODEL: Tiger Moth ARF

TYPE: biplane

WINGSPAN: 72 in.

LENGTH: 50 in.

WEIGHT: 10.5 lb.

WING AREA: 1,650 sq. in.

WING LOADING: 14.67 oz./sq. ft.

ENGINE REQ'D: .60 to .90 2-stroke or a .90 to 1.20 4-stroke

ENGINE USED: Zenoah G-23

PROP USED: APC 16x6

RADIO REQ'D: 4-channel (aileron, elevator, rudder, throttle)

RADIO USED: JR 10X

PRICES: $289 (film); $319 (fabric); $259 (uncovered)

COMMENTS: the Dymond Tiger Moth ARF is a sport-scale biplane with excellent performance, and it's very easy to build and fly. The model has four ailerons, but the full-size airplane had only two.

HITS

- Good quality wood and hardware.
- Excellent flying characteristics.
- Quick to build.

MISSES

- Slots for the landing-gear wires were too narrow.

ASSEMBLY

Start by joining the wing panels. Slide the aluminum dihedral braces into the root ribs, and slide the wing panels together. For the top wing, two black aluminum crossbars hold the panels together and join the wing to the cabane struts. Make sure to place the shorter crossbar aft when you screw them into place. For added strength, I "hardened" the attachment screw holes by applying a few drops of thin CA. The bottom wing also uses aluminum dihedral braces, but its panels are held together with alignment dowels and the nylon wing-hold-down bolts.

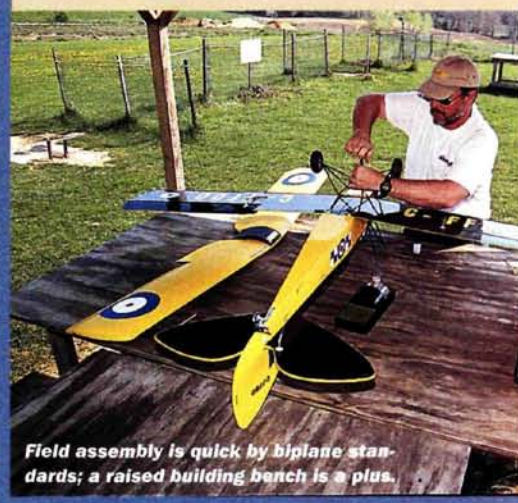
FUSELAGE

The fuselage is a simple, strong and light box structure. The forward and aft turtle decks are foam covered with balsa. The removable fuselage hatch makes installing the fuel tank and radio gear a snap. The firewall and wooden engine-mount rails are already in place and have been fuel-proofed with resin; side- and downthrust have already been incorporated into the structure.

It's easy to attach the tail feathers to the fuselage; simply remove the covering material on the underside of the stab and glue the control surfaces into place. I used CyberBond 30-minute epoxy to allow time for the minor adjustments needed to keep the surfaces straight. Attach the tailwheel assembly to the rudder before you glue the fin into place. Dowel pushrods come assembled and already installed. Install the servos and center the output arms before you attach the pushrods to the elevator and rudder. After the pushrods are attached to the servos, adjust the clevises to center the control surfaces.

The aluminum cabane struts must be screwed into place on the sides of the fuselage; the attachment screw holes have been drilled for you. Instead of using locknuts to secure the attachment screws, I installed 4-40 blind nuts with flat washers under the cap-head screws. The washers prevent the screw heads from pulling into the long slots in the cabanes; those slots allow you to adjust the top wing's incidence.

The landing gear comes formed and soldered together. Four metal straps hold the front and rear struts in slots that have been cut into the fuselage and lower wing. In my kit these slots were too narrow, so I enlarged them with a Moto-Tool and a small, grinding bit. The landing gear was finished with a thick coating that made the axles too big for the wheels to slide on. I enlarged the holes in the wheels so they would slip over the axles, and then I ground down the ends of the axles so that



Field assembly is quick by biplane standards; a raised building bench is a plus.

With either the cockpit section or the bottom wing removed, you have complete access to the radio and fuel tank.

the wheel collars would fit over them. The landing gear looks scale, but you must remove it to take off the bottom wing.

The lower wing panels come with the aileron-servo-wire extension leads already in place, and this makes the servo installation very easy. Simply attach your servo's lead to the extension, pull the wires through the wing and install the servo. A tight-fitting servo well is built into the bottom of each wing panel, and I was able to glue my servos into place with PFM adhesive. Plastic hatch covers come with the kit, but for simplicity, I left them off.

The kit has eight interplane strut attachment fittings that you must install in slots cut into the wing panels. Once these

T-shaped fittings are screwed into place, you can attach the interplane struts to the fittings and join the wings. Twelve 4-40 screws and locknuts are used to secure the wings.

FINAL ASSEMBLY

I used a JR 10X transmitter and NES 4135 servos for all the control surfaces and an NES 531 for the throttle. I used separate aileron channels (I mixed the aileron channel with Aux. 2 channel) and activated the flaperon-mix function. This gives a bit of redundancy to the control system and allows differential throw to be added to the ailerons. I connected the upper and lower ailerons with metal 2-65 pushrods soldered together to make "double-wide" pushrods. Plastic attachment brackets and plastic clevises complete the aileron linkages.

To compensate for the G-23's greater engine weight, I installed a large 1800mAh battery pack in the fuselage just aft of the lower wing's trailing edge. I finished the model by installing a ⅛-scale William Bros. pilot figure. So the pilot figure had something to look at, I used the supplied instrument-panel decals. These were much too large, so I cut them to size before sticking them in place.

CONTROL THROWS

For the first flight, I set up the control throws using the instruction's recommended values: ailerons ¾ inch up and down; elevator 1 inch up and down; rudder 2½ inches left and right.

The cabane struts are made of black-finish aluminum and are screwed into place.

The model's balance point is between 7 and 7¾ inches back from the top wing's leading edge. After several flights, I found that the aft-most position was best for me. The center of gravity (CG) seems awfully far back, but this is because of the model's swept-back wing panels. Start at the front position for your first flight and slowly move the CG back until you are comfortable with the model.

I am extremely pleased with the Dymond Modelsports Tiger Moth ARF. It's very easy to assemble, and, even better, it is a wonderful flying model. A Zenoah G-23 allows the model to do every

FLIGHT PERFORMANCE

TAKEOFF AND LANDING

The Dymond Tiger Moth has a long tail moment, which makes it very stable in yaw. I had no problem keeping the model on track during the takeoff run. The Zenoah G-23 turning an APC 16x6 prop produces a lot of takeoff thrust; advance the throttle slowly and let the model accelerate gradually. The tail comes up in a few yards, and the model becomes airborne with a slight amount of up-elevator. Once the model gained more airspeed, I added some more up, and it climbed with authority.

When it is time to land, you'll find that the Tiger Moth is like any other biplane—it loses some airspeed during the approach. I used just under ⅓ throttle on final and kept the nose down until the model was over the end of the runway. The transition to the flare is effortless; as the model begins to settle, cut the engine to idle and slowly pull back on the stick until the model is in a 3-point-landing attitude. Continue pulling back on the stick until the model stalls just as the wheels touch the ground. The model is very predictable during landing and doesn't show any signs of tip-stalling.

SLOW-SPEED PERFORMANCE

With the throttle pulled back and the model trimmed for slow speed, you'll find that all the controls remain responsive. Roll (with four ailerons) remains solid, but a little more elevator is needed for pitch changes; rudder feels softer but yaw control remains adequate. In a stall, if you keep the wings level the model breaks straight ahead. By neutralizing the elevator and adding power, the model recovers immediately.

HIGH-SPEED PERFORMANCE

With the G-23 in its nose, the Tiger Moth can really get going. At full throttle the model doesn't feel twitchy, and it can climb at an extremely steep angle. Be sure to pull the throttle back when you push the nose down into level flight. Though I never experienced flutter, if you don't throttle back, you could push the model too far in a dive.

AEROBATICS

The Tiger Moth was not designed for unlimited aerobatics but with its non-scale 4-aileron setup, it will preform excellent maneuvers. Roll rate is fast and extremely axial. Even on low control rates, you'll love how well the model rolls. Also, with a bit of differential aileron, there's very little, if any, adverse yaw.

There is plenty of rudder authority, and you can fly the model with or without coordinated aileron and rudder. Of course, the turns will look better if you coordinate them. Loops are easy with the G-23, and you can easily enter the maneuver from level flight at full throttle. Wingovers and Cuban-8s are also easy, but the model doesn't snap-roll very well at the normal control-throw settings. This is perfectly OK because we are talking about a Tiger Moth—not a Pitts Special!

G-23 INSTALLATION

Although the model is intended for a glow-powered engine, I installed a Zenoah G-23 gasoline engine. To do this, I cut off the front part of the fuselage forward of the firewall and installed a pine spacer block that placed the G-23 in the correct position. To fit the engine within the narrow engine cowl, I removed the condenser coil from the engine and attached the coil to the firewall just behind the cylinder head. I ran a ground lead from the coil to the engine case to reestablish the ignition circuit.

To make the engine fit into the narrow cowling, I placed the engine's condenser coil on the firewall behind the cylinder. A ground wire completes the ignition circuit.

To drive the throttle linkage, I made a wooden standoff to support a 90-degree bellcrank. To allow the cowl to come off in one piece, I used a low-profile J-Tec muffler and cut off most of the exhaust stacks. The Walbro carb extends out of the cowl, so choking the engine during starts is very easy. The carb has to be removed to take the engine cowl off; that is easily done by removing and replacing two screws.

I installed a wooden spacer to place the G-23 at the proper location. Note the plywood support for the throttle linkage.

Next, I installed the fuel tank and fuel lines. I used a 2-line fuel-tank setup with a large T-fitting installed in the main feed line; the tank is filled through the T-fitting. Since the engine has a Walbro pumper carb, the fuel doesn't flood the engine; it only flows into the tank. To run the engine, the T-fitting must be sealed with a plug.

maneuver in the book. If you are looking for a fast-building bipe with classic lines, the Dymond Tiger Moth ARF will impress you. ✈

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Cyberbond, 401 N. Raddant Rd. Batavia, IL 60510; (630) 761-8900; fax (630) 761-8989; www.cyberbond1.com/hobby.cfm.

Dymond Modelsports USA Ltd., 683 N. Main St., Oshkosh, WI 54901; (888) 4FUN FLY; (920) 303-1100; fax (920) 303-2021; www.rc-dymond.com.

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Williams Bros., 1119 Los Olivos Ave., Unit #3, Los Osos, CA 93402; (805) 534-1307; fax (805) 534-1366; www.williamsbrosinc.com.

Zenoah; distributed by Horizon Hobby Inc.

MODEL Airplane NEWS

THE GREAT RC REDESIGN CONTEST

Customize your ARF and cash in!

We love the quality and convenience of today's ARFs, and judging by how well they're selling, you all do, too. The only problem is that when the factory does the covering, all the planes look the same, and that gave us the idea for our next contest. We want to see what you do to personalize your ARF. What changes do you make or details do you add to make a prebuilt model your own?

Do you dress it up with decals or trim? How about scale details? Or maybe you go deeper and make structural changes to personalize your plane. Well, whatever you do, we want to know! Send us a good-quality photo, or email us a high-resolution digital image of your plane on the ground, showing the changes you made. Include a brief description (100 words or so) of what you did to the model and how. The only limitation (besides you imagination) is that your entry must be based on a commercially available ARF and must retain the model's essential character.

Grand Prize: $500

Second Prize: $250

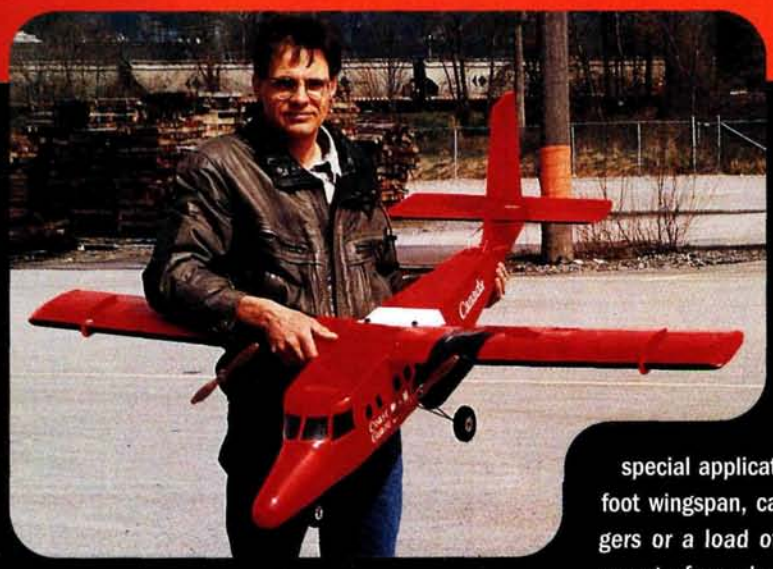
Third Prize: $100

All winners will also receive a copy of "Customizing RC Airplanes" by Faye Stilley. Runners-up will be sent a *Model Airplane News* hat and T-shirt.

You can customize it in any way you like, but our criterion for selecting a winner will be the best modifications—not the most modifications. We want to see how your plane reflects your sense of style and originality.

Please print your name, address and daytime phone number on your entry and send it to: "Customizing your ARF Contest," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4066 USA, or email us at man@airage.com. If you would like your materials returned to you, please include an SASE.

de Havilland TWIN OTTER



by Anton Eisele

A sport-scale model of DH's workhorse

The Canadian de Havilland Turboprop Twin Otter was designed for use as a regional commuter and for other special applications. The plane has a 65-foot wingspan, can carry up to 12 passengers or a load of 4,400 pounds and can operate from short runways. This 1/12-scale design of the Twin Otter makes a great 4-channel model that can be powered by a pair of geared Speed 480 electric motors or small .10-size glow engines. Because the model has a high-lift wing, I decided not to use flaps, but the ailerons are large enough to be used as flaperons if you're looking for STOL capability. If you go this route, you'll need to modify the wing for dual-aileron servos and use a radio with flaperon programming. If you're really into scale, there are lots of websites that can give you information on color schemes and scale detailing.

SPECIFICATIONS

MODEL: de Havilland Twin Otter

TYPE: sport-scale twin electric

SCALE: 1/12

WINGSPAN: 65 in.

LENGTH: 50 in.

WEIGHT: 3.5 to 4.5 lb.

WING AREA: 455 sq. in.

WING LOADING: 17.7 to 22.8 oz./sq. ft.

POWER REQ'D: 2 Speed 480 motors, or 2 .10 glow engines

POWER USED: 2 Kyosho 7.2V Speed 480s w/2 Maxx 2.5:1 gearboxes, a Schulze 35e ESC and an 8-cell, 2000mAh battery

PROP USED: Master Airscrew 10x6 electric

RADIO REQ'D: 4-channel (elevator, rudder, aileron, throttle)

FLIGHT DURATION: 4 to 6 min.

COMMENTS: designed by Anton Eisele, the de Havilland Twin Otter is an easy-to-build sport-scale twin for electric power or twin .10 glow engines. The model uses traditional balsa and ply construction, and the plan is highly detailed.

CONSTRUCTION

The wing with its constant chord is easy to build and has 3 degrees of dihedral on each panel. Start by cutting out the ribs from the material listed on the plan. Cut the top and bottom sheeting from a sheet of 1/16x3x36-inch balsa, and pin the bottom sheet to the plan. Glue the bottom 3/8x3/16-inch balsa spar onto the leading-edge sheet so that only half of the spar width is on the sheeting. Glue the ribs into place and then glue on the top spar. Use the dihedral gauge on the plan to set the dihedral angle of the root ribs.

Now add the top leading- and trailing-edge sheeting, the 1/4-inch balsa at the end of the aileron ribs, the capstrips and the shear webs. Be careful not to sheet the area where the nacelles will go. Flip the wing and glue on the remaining bottom sheeting and the capstrips. Sand the leading-edge sheeting so it's even with the ribs and then glue on the 1/4-inch leading edge. Before the wing halves are joined, shape the leading edge to the rib profile.

Cut out the nacelle sides from 1/8-inch plywood and glue them into place. Next, install the bellcranks and aileron pushrods, and route the motor wiring; you'll need to cut a small hole in the webbing at the nacelle for the motor wires.

This view of the top of the left wing shows the nacelle during construction. The formers are in place and are ready to be sheeted.

Here's the right wing panel minus the motor nacelle. Note the simple aileron bellcrank and pushrod system.

FSP0502 de Havilland Twin Otter

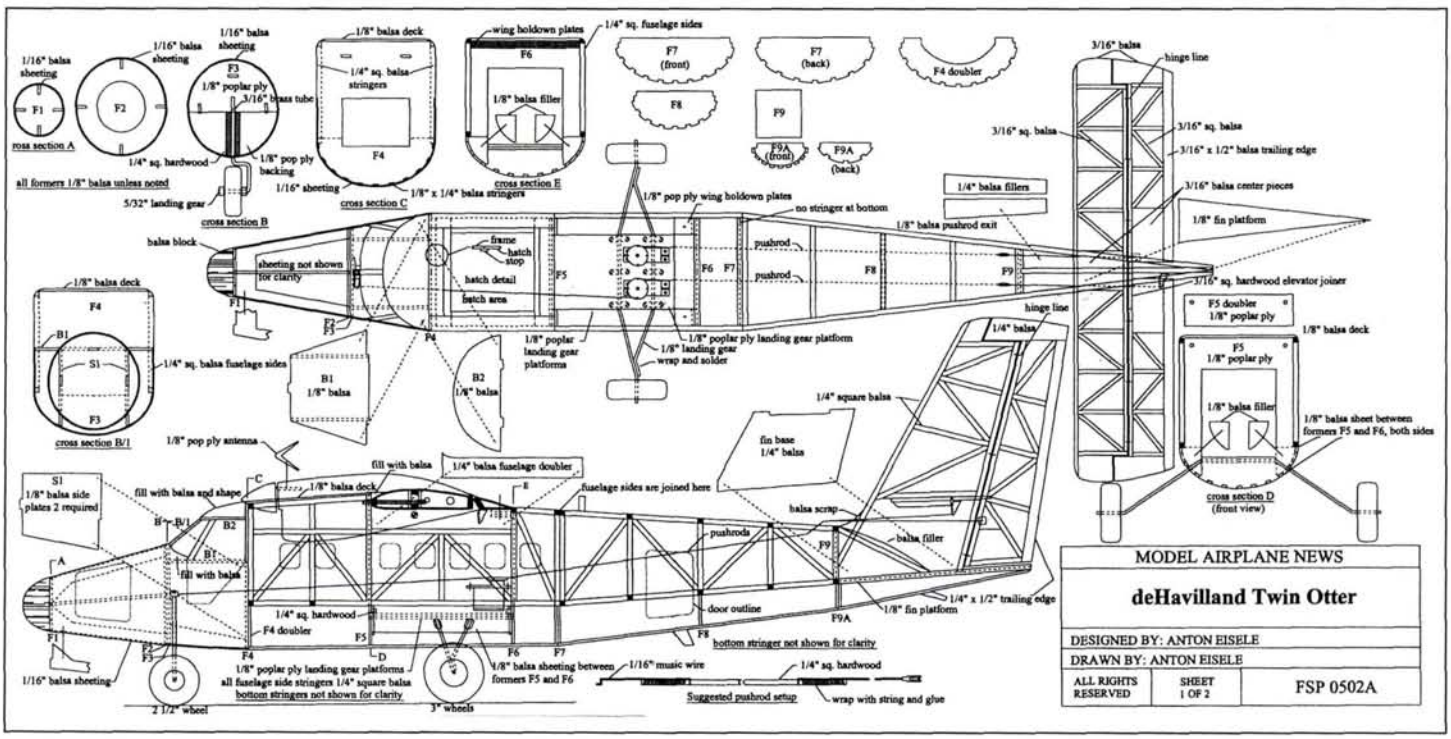
Designed by Anton Eisele, the de Havilland Twin Otter is an easy-to-build sport-scale twin for electric or twin .10 glow engines. The model uses traditional balsa and ply construction, and the plan is highly detailed. WS: 65 in.; L: 50 in.; engines: 2 Speed 480 electric motors or 2 .10 glow engines; radio: 4-channel; LD 2. **$19.95**

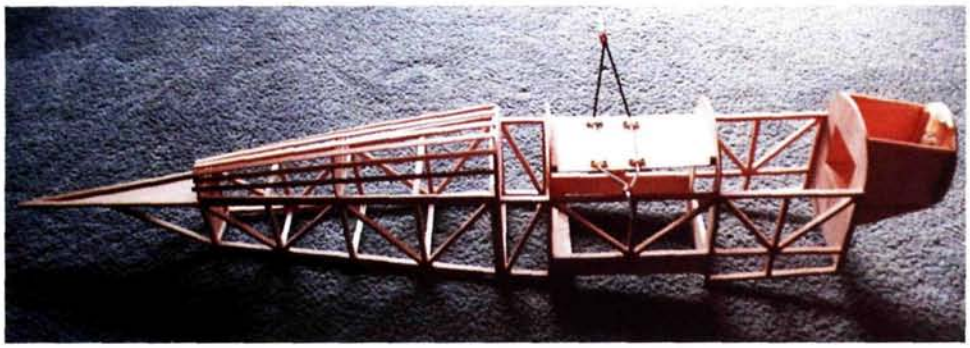
Join the wing halves with two plywood braces, sheet the center section of the wing and build the ailerons as shown on the plan. I mounted the aileron servo on a plate that slides into 1/4-inch hardwood rails, and I secured the plate with a single screw.

NACELLES

Glue formers N1, N2, N3 and N4A onto the nacelle sides, and sheet the top and bottom with 1/2-inch-wide strips of 1/16-inch balsa. Build the cowl by gluing formers N1A, N2A and N3A onto the 1/8-inch plywood cowl floor, and plank them with 1/16-inch balsa strips. Make the front section of the cowl out of 1/4-inch balsa and then sand it to shape. Screw the cowl to the front of the nacelle, and peg it to the rear of the nacelle.

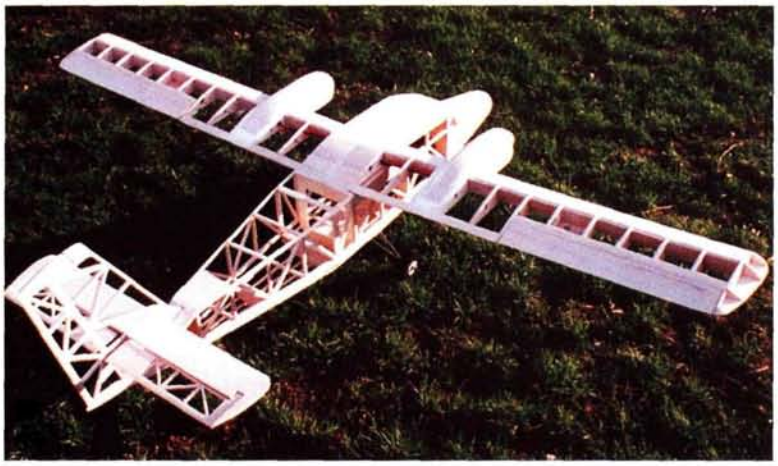
To order the full-size plan, turn to "RC Store.com" on page 130.





The fuselage has been framed except for the belly and nose bottom. Build the nose cone separately and add it later.

Glue the motor-mounting plate and the ¼-inch and ⅜-inch-square hardwood rails into the nacelle. The motors are held in place with a ½-inch-wide metal strip that's screwed into the ⅜-inch hardwood rail.



Here's the Twin Otter, built and ready to cover. Note that the stabilizer should be open frame and not sheeted as shown here. Just follow the plan.

FUSELAGE AND TAIL ASSEMBLY

The fuselage construction is unique; the sides are built of ¼-inch balsa sticks as front and rear sections (I find it easier to make the sections square and true that way). I then add the formers and longerons to give the fuselage its shape. Begin by building the two fuselage sides over the plan and gluing in the ¼-inch balsa wing saddle. When they're dry, remove the fuselage sides from the plan, clamp them together and sand them to make them identical.

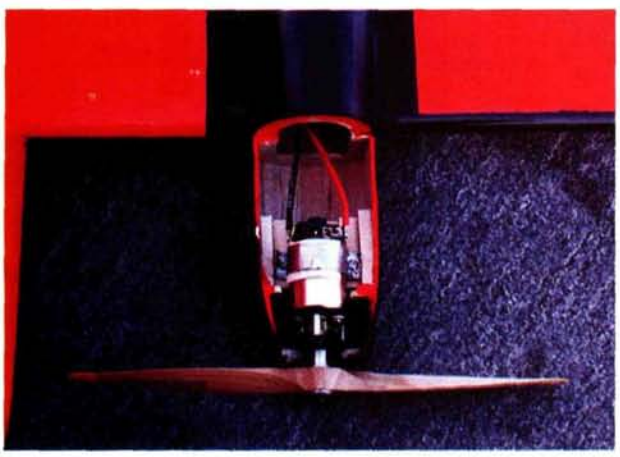
Join the aft halves with ¼-inch-square balsa sticks, former F9 and the ⅛-inch balsa fin platform, using the plan to get everything straight. Next, join the front halves by gluing formers F5 and F6 onto one of the fuselage sides and then gluing the other side onto the formers. Again, make sure everything is straight and true and then add the horizontal stringers.

Next, glue the front and back fuselage sections together and add F4 (note that it fits on the front of the fuselage box, not in between the fuselage sides). Build the box that goes between F3 and F4 from B1 and two S1s and fit them into F4.

Epoxy the 5/32-inch-i.d. brass sleeve onto F3, glue F3 onto the box and sheet the area between F3 and F4 with 1/16-inch balsa. Note that the sheeting goes only as high as B1.

Glue the two ⅛-inch plywood main landing-gear plates into place between formers F5 and F6. The main landing gear is made of ⅛-inch-diameter wire, and the front gear is made of 5/32-inch-diameter wire. Now add the rest of the formers and the ⅛x¼-inch balsa stringers. Note that the number of stringers decreases toward the rear of the fuselage.

Build the nose by gluing the balsa platform and the two ⅛-inch balsa stringers onto former F1. Now glue on former F2, sheet the nose with 1/16-inch balsa and then add the balsa nose block. Glue the assembly to F3. Place the wing on the fuselage and make the holes for the 3/16-inch-diameter wing hold-down dowels by drilling through F5 and into the leading edge. Remove the wing, and glue the dowels into it. Build the front deck and the battery access hatch out of ⅛-inch balsa. Glue B2 onto the front of F4, fill the top part with soft balsa and sand it to shape. Carefully sand the entire fuselage, and set it aside.



Here, the cowl has been removed to show the Speed 480 motor strapped into place. I placed a piece of balsa in front of the gearbox to prevent it from sliding too far forward.

Using the plan, build the fin, rudder, stabilizer and elevators and then shape the leading and trailing edges; do not assemble the elevator halves yet. Note the ¼-inch triangular reinforcement under the stabilizer where it meets the fin. It's best to cover the tail assembly first before permanently gluing it into the fuselage.

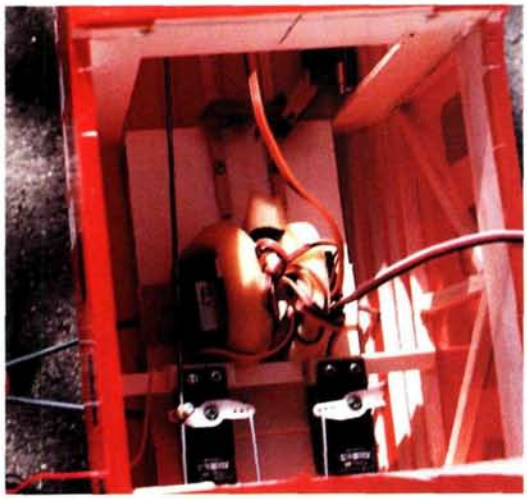
FINAL ASSEMBLY

Glue the tail assembly into the fuselage, and use slow-curing glue to give you time to align it. Put the wing on the fuselage, align it and drill the wing-bolt holes through the trailing edge and the wing-mounting plate. Tap the plate with a ¼-20 tap, bolt the wing on and recheck the alignment.

I covered the plane with UltraCote and painted the black trim with enamel spray paint; I cut the rest of the trim from white covering material. For servos, I used a Hitec HS-81 for the ailerons and standard servos for rudder and elevator. To power the model, I used a pair of Kyosho Speed 480 motors with Maxx Speed 400 metal gearboxes (I had to trim the gearboxes a bit to make them fit the Speed 480s) with 2.5:1 ratio turning Master Airscrew 10x6 electric wooden propellers. I found this combination to be the best compromise between thrust and speed. I also used an 8-cell, 2000mAh battery pack and a Schulze 35e speed controller wired in parallel.

GENERAL FLIGHT CHARACTERISTICS

Now to the fun part! Most modelers have the notion that twins are difficult to fly—



There's plenty of room to mount the radio equipment. Note the rails for mounting the battery pack.

not so with electric power! Glow twins can be tricky to set up for a good flight, but electric motors almost always run at the same speed, and the chances of one motor quitting are very slim. It has never happened to me.

Initial flight tests took place on a rather windy day—good for quick take-offs but not for flying a lightly loaded plane. After a final check, I let the plane run until it reached its maximum ground speed and then eased in some up-elevator; the climb was steady and not too steep.

The only trim needed was a bit of up-elevator. The Twin Otter flies rather slowly, so it appears quite scale in the air. The rudder is very effective, and I recommend using it more than the ailerons for turning. Stalls are flat, and recovery takes only a few feet. The plane has no bad tendencies. I did low and slow passes in a brisk wind without worrying about the motors missing a beat.

After one more fly-over, I made the final approach. I throttled back to ⅓ power and let the plane sink to about five feet above the tarmac; then I reduced power to idle and flared out. With the wind, the model landed at a slow pace on its main gear. This plane is easy to fly, and if you use glow engines to power your plane, you will get more speed. Just be careful with man-euvering; remember, the plane is lightly built.

CONCLUSION

This model is easy to build and even easier to fly; anyone who has basic building skills can complete it. Its gentle flight characteristics make for a great twin trainer, and it's relaxing to cruise around with. Wouldn't it look great on a set of floats? Have a go at this unique twin; you won't be disappointed!

Kyosho; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; (217) 398-6300; fax (217) 398-1104; www.kyosho.com.*

Master Airscrew; *distributed by Windsor Propeller Co., P.O. Box 250, Rancho Cordova, CA 95741-0250; (916) 631-8385; fax (916) 631-8386; www.masterairscrew.com.*

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Durable fiberglass floats with scale appeal

Commander R/C Sea Commander floats

by Jim Onorato

If you have been dying to fly your latest scale beauty off water but haven't been able to find a pair of floats to do it justice, Commander R/C may have just what you're looking for.

Sea Commander EDO Series floats are designed for serious modelers who want the best, most dependable floats that money can buy. Three layers of fiberglass cloth and isophthalic resin make them strong, light, very durable and good-looking. One-quarter-inch-thick Coremat (a composite material that allows sheet-metal screws to be installed directly into the fiberglass floats) reinforces the strut and water-rudder mounting positions. Other features that add to the floats' durability include molded-in fiberglass joiner lips, side stiffeners, bottom reinforcements and three fiberglass bulkheads.

Sea Commander floats are round on top and have an 18-degree V-bottom to help cushion the impact of hard landings and to improve directional control on the water. In addition to being tough, Sea Commanders come built and ready for priming and painting. They're available in 11 sizes ranging from 29 inches to 64 inches, and they cost between $86.90 and $350 a pair. To determine the length of the floats required for your airplane, multiply its overall length by 0.75.) The 46-inch Sea Commanders I review are perfect for my Balsa USA ¼-scale Cub.

MOUNTING SYSTEM

It goes without saying that if you are looking for scale realism, the floats' mounting system is as important as the floats themselves. Well, Commander R/C offers a system that closely duplicates the one used on full-scale floatplanes, and it's one that should satisfy most scale modelers. It consists of 6061 T6 aluminum spreader bars (with a 0.035-inch-thick wall), aluminum-bar-stock end fittings, stainless-steel locknuts, 4-40 stainless-steel socket-head bolts and washers, stainless-steel sheet-metal screws and aluminum brackets designed to fit the curve of the floats' sides. You can purchase the entire kit or just the parts you need. Each comes with fully detailed photo-illustrated instructions.

When I received my Sea Commanders, I was very impressed by the workmanship and the quality of materials provided for the mounting system. I knew that it would be an interesting and rewarding project.

The floats come with a guide for sizing and placement. The distance from the centerline of one float to the centerline of the other—the "track"—should be 17.5 to 18 percent of the wingspan for scale mounting and 20 to 25 percent for sport mounting. Because I'm not a true scale modeler and because I wanted to ensure excellent water handling,

I decided on a track of 20 inches, which is 19 percent of my Cub's 108-inch wingspan.

ATTACHMENT BRACKETS

Before beginning assembly, I made a Styrofoam work stand to hold the floats parallel, level and 20 inches apart. I inserted dowels in the stand and held the floats firmly in place with heavy rubber bands. I then drew a centerline on the Styrofoam between the floats.

The first step in building the scale mounting system was to install the attachment brackets and the spreader bars. The attachment brackets fit on the curved sides of the floats rather than on their tops. They consist of a ⅜-inch bar-stock end fitting sandwiched between two aluminum side plates. The total of eight side plates come cut to shape but must be bent and drilled. I center-punched and drilled the two small tabs on each of the side plates for no. 4 sheet-metal screws and bent the tabs 90 degrees at the bend lines shown in the instructions. After trial fitting them against one float at the desired location, I clamped two side plates to each of the four pieces of ⅜-inch bar stock to make up four attachment brackets.

I did not permanently bolt the side plates to the bar stock as

SPECIFICATIONS

Product: Sea Commander Edo 2000 Series scale floats

Manufacturer: Commander R/C

Type: scale floats for .15 to 1.20 aircraft (.90 to 1.20 version reviewed)

Length: 29 to 64 in. (46 in. reviewed)

Weight: 10 to 56 oz. (26 oz. reviewed)

Price: ranges from $86.90 to $350 ($195.80 reviewed)

Features: constructed of three layers of fiberglass and isophthalic resin for added durability; molded-in fiberglass joiner lip and side stiffener; molded-in fiberglass bottom reinforcements; three fiberglass bulkheads; four watertight compartments; composite reinforcements in scale mounting positions; composite reinforced transom for water-rudder mounting.

Comments: Sea Commander floats are constructed of extremely durable materials and the mounting system closely resembles that of its full-scale counterparts. When it comes to scale realism, Sea Commander floats are tough to beat.

ON THE WATER

With the exception of the water rudders, I completed the assembly of the Sea Commander floats just as the boating season here in Connecticut was coming to an end. Since I wanted to see how well they'd work before I took my boat out of the water for the winter, I decided to test them out for the first time without the rudders. On the next sunny, calm day, we headed for the lake.

The first order of business was to see how well they'd sit in the water. I assembled the Cub on shore and set it down at the water's edge. The floats drew surprisingly little water and held the Cub perfectly level. They really looked great! After getting a few pictures, we loaded the Cub onto the boat and headed out to the middle of the lake for the first flight.

I set the plane in the water, started the engine and turned it away from the boat. I started by taxiing around to see how well the floats would handle without the water rudders and was happy to see that the Cub's rudder provided enough steering control. As I gradually increased the throttle, the Sea Commanders held the Cub on a steady track and were quickly up on the step. The 18-degree V-bottoms did their job and maintained directional control. When the Cub attained flying speed, I added just enough up-elevator to get airborne. The scale appearance was awesome!

Landing at a moderate speed, the Sea Commanders kissed the water and settled in nicely. The rigidity of the struts was apparent; they did not flex at all on landing.

The attachment brackets fit on the curved sides of the floats instead of on the tops. They come in three pieces: two aluminum side plates and a ⅜-inch bar-stock end fitting.

The scale mounting system is complete. Its assembly is challenging but well worth it. The end product looks very true to scale.

indicated by the instructions. The instructions tell you to use a small bubble level to position the attachment brackets accurately on the side of the floats. Though this might have positioned the brackets so that the bar stock would be horizontal, there was no assurance that the brackets would be perpendicular to the float's centerline unless they were bent and assembled precisely. I was certain that all four of the attachment brackets would not be identical, so I used a single bolt to hold them together temporarily, and that left room for final adjustments after I had inserted the brackets into the spreader bars.

SPREADER BARS

Next, I measured and cut the spreader bars to length and slipped an attachment bracket into the ends. I aligned the spreader bars and attachment brackets so that they were parallel, level and perpendicular to the floats' centerlines. When I was satisfied with the alignment, I drilled the floats and attached the brackets with no. 4 stainless-steel sheet-metal screws. I then finished bolting the side plates and the spreader bars to the bar stock. When I had finished, I had a very rigid, strong assembly. The entire procedure would have been much simpler had the side plates been prebent and drilled. It was almost impossible to get them all bent identically by hand.

N-STRUTS

I turned my attention to the N-struts next. I made a cradle out of the Styrofoam to hold the fuselage centered between the floats with approximately 1 degree of positive incidence with the center of gravity ½ inch forward of the step in the floats. I set the height of the plane so that the bottom of the prop arc would be about 2 inches above the tops of the floats. Since I had to lift the fuselage slightly to insert the struts into the fittings during assembly, I did not lock the fuselage in the cradle. I also marked the outline of the cradle on the base so I'd be able to reposition it as needed.

Following the patterns in the instructions, I made mock-ups of the N-struts using ⅛-inch balsa. By attaching them in the proper locations, I was able to identify all of the correct angles and lengths of aluminum tube needed.

Following the pattern suggested in the instructions, I made mock-ups of the fuselage/strut attachment brackets out of thin cardboard and used 1x⅛-inch balsa to make the N-strut patterns. Temporarily taping the mock-ups in the correct locations told me the angles and lengths of tube I'd need for the struts. I transferred the strut patterns to the strut material and cut them to length at the proper angles. I cut the fuselage/strut attachment brackets out of two pairs of aluminum landing gear that I had in my shop. You must use T6 aluminum for the fuselage/strut attachment brackets to get the necessary strength. When everything was properly aligned, I bolted all the pieces together with stainless-steel locknuts, bolts and washers.

Cutting the slots in the bar stock was one of the most time-consuming steps. I used a Dremel table saw with a carbide blade, but a metal-cutting band saw would have been better. It would have been even better if the bar stock had been preslotted.

I made cross-braces out of 4-40 wire using Du-Bro threaded rod ends and attached them with metal landing-gear straps. I placed a small O-ring in the center of each cross-brace to damp any chance of rattling.

All in all, I found this a very challenging project but one that was certainly worth the effort. The result is outstanding!

Du-Bro Products, P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604; www.dubro.com.

Commander R/C Models, Hangar 2A-5333 216 St., Langley, BC, Canada V2Y 2N3; (877) 514-3027 (toll-free in U.S. and Canada); (604) 514-3027; fax (604) 514-3028; www.seacommander.com.

HOW TO

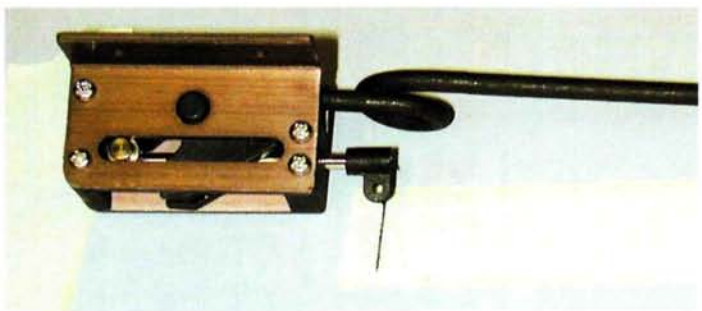
Install mechanical retracts

by Rick Bell

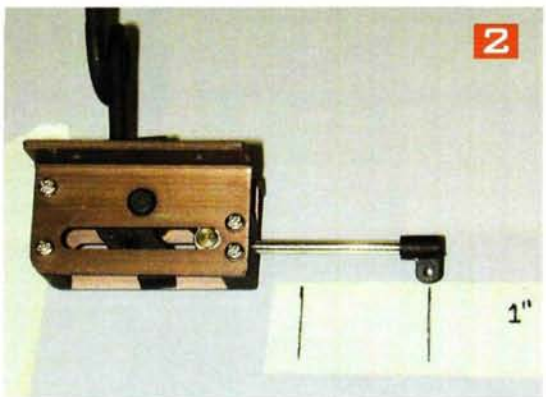
Landing-gear upgrade made easy

Retractable landing gear look great and they are the finishing touch to many scale models; I've also found that mechanical retracts are a great way to add realism. They're light, reliable, inexpensive, easy to install, require very little maintenance and come in sizes to suit most models. With a little extra effort during construction, you can easily enhance your model's scale looks and also reduce drag.

For this article, I used Kyosho's Spitfire wing and Hobbico mechanical retracts. Although the Spitfire is an ARF, any wing that has room for the wheels inside it can be modified for retracts. I'll show you how to correctly set them up; let's take a look.

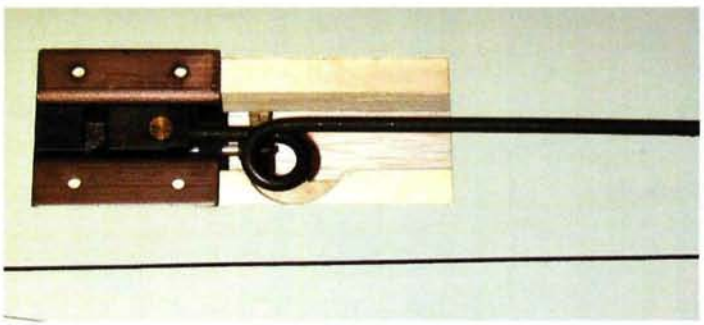


1 First, you must determine the stroke of the actuating cam from its up and locked position to down and locked. I use a couple of pieces of masking tape for alignment and mark the center of the pushrod horn with the gear in the retracted position.



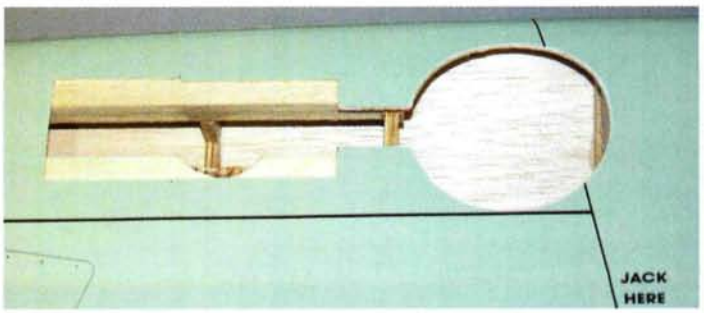
I've now fully extended the gear to the down and locked position. Make another mark centered on the horn and measure from line to line; in this case the stroke is 1 inch.

3 Now take a servo wheel of the appropriate size. From the center of the wheel, measure half of the stroke (½ inch) and drill holes in the wheel on each side of center for the pushrods, or EZ connectors. This will make the distance between the holes the required 1 inch. Remember, the retract servo will rotate the wheel 180 degrees, and the hole will travel the distance needed.

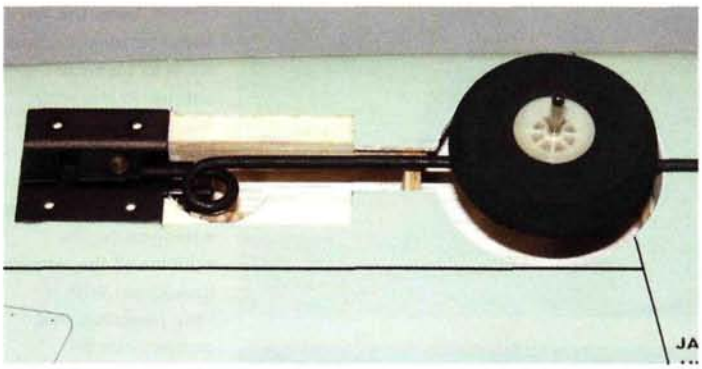


4 Next, determine where to place the wheel well. You can use the kit-supplied torsion wire gear and measure from the bottom of the wing to the axle. Now use this measurement to mark the wing from where the landing-gear leg exits the wing (the mark is the center of the wheel).

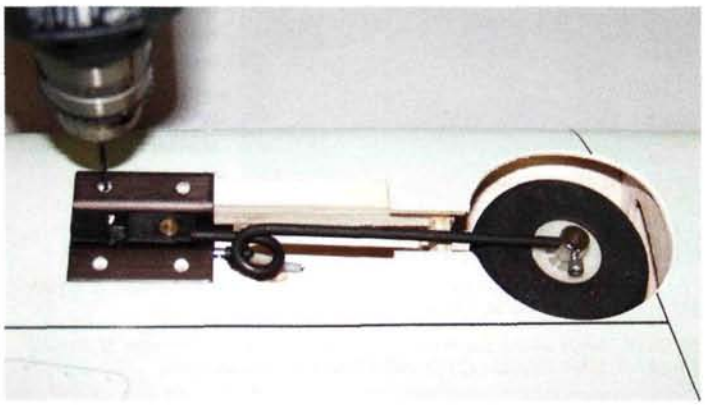
Another option is to just mark the wing for the gear length you want; just remember to make the gear long enough to allow the prop to clear the runway surface.



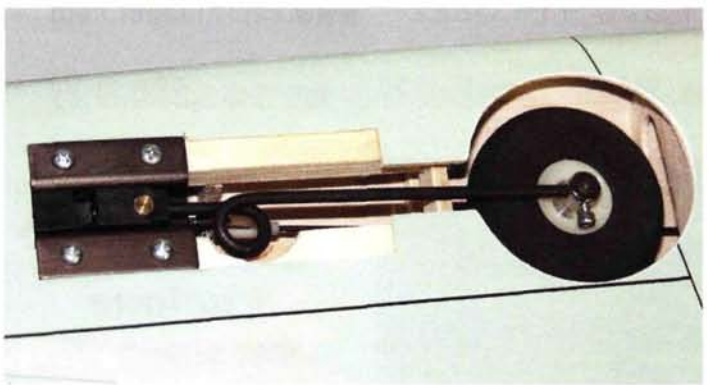
5 Now cut out the opening for the wheel well, making it at least ½ inch larger in diameter than the wheel. When you've finished cutting out the wheel well, the landing gear will be able to flex a bit, and that will prevent the wheel from binding in the wheel well. Also make a cut for the landing-gear leg; make sure it's wide enough for the leg to clear easily.



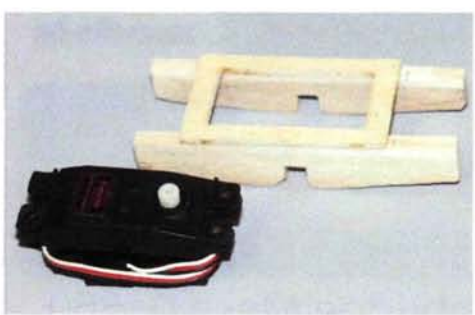
6 After you've cut out the wheel well, check the fit of the retract and the wheel, and make any necessary adjustments.



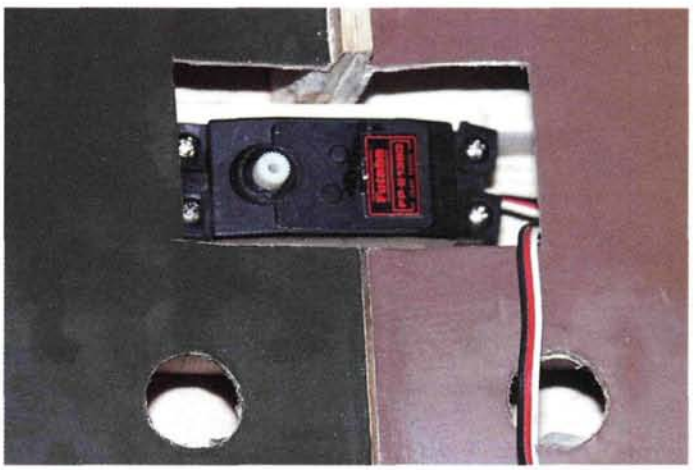
7 When you're satisfied with the fit, drill pilot holes for the mounting screws. Be sure to harden the holes with a few drops of thin CA.



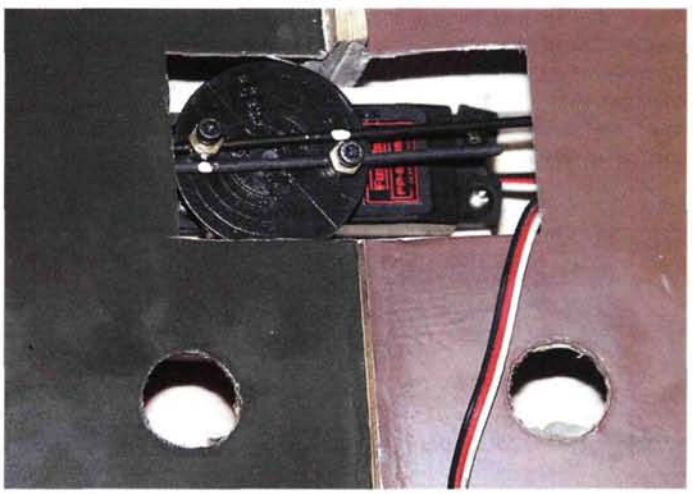
8 Here, the landing gear is fitted and ready for the next step. Now is a good time to line the wheel wells with 1/16-inch balsa; or if your kit provides molded wheel wells, trim and fit them.



9 Make the retract servo mount from plywood and balsa and fit it into the wing; it must be securely glued into the wing for proper operation. Note the notches in the mount to clear the root ribs.

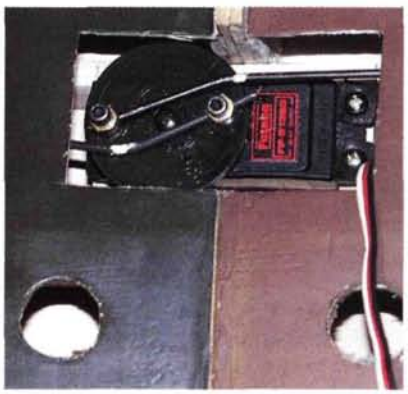


10 Now mount the retract servo in the wing, and mount the landing gear with the pushrods attached to the cams. Hook up the retract servo (but not the pushrods) to your radio system and determine which switch direction (up/down) raises or lowers the gear. I like the switch to be in the down position to indicate that the gear is down.

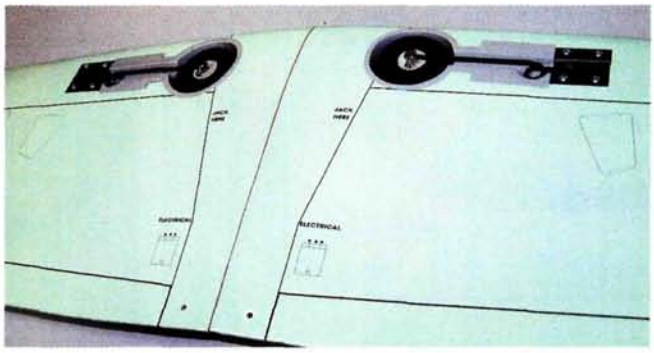


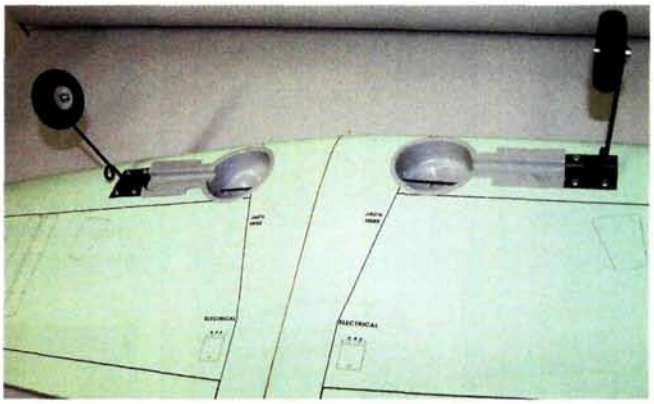
11 Install the servo wheel and slide the connectors onto the pushrods, then push the connectors onto the servo wheel. Now manually extend the gear and note the position of the pushrod when the gear is down. To prevent the pushrods from binding against the connectors, bend them slightly. I place a drop of "Wite-Out" (paper correction fluid) on each pushrod where it touches the connector.

12 Remove the connectors and the servo wheel and make the bends just in front of the marks you made; also cut and remove any excess pushrod material. Reinstall the servo wheel and secure the pushrods to it, and manually rotate the servo to check for any binding. By doing so, you'll avoid damaging it if the setup is reversed. If the manual rotation is OK, hook up the servo and use the radio to cycle the landing gear. Don't get mesmerized watching the gear go up and down! Here the servo is in the down position; notice how the pushrods clear the connectors.



13 Here, the servo wheel has rotated 180 degrees and the gear is in the up (retracted) position. The EZ connectors are allowed to rotate in the servo wheel, and they will provide reliable service if the pushrods have been properly adjusted. You could use Z-bends instead of the connectors, but you'll need to be very precise making the bends.





14 The result! I used the kit-supplied plastic wheel wells to hide the cutouts in the wing; 1/16-inch balsa could also be used. The plane takes on an entirely new character when you hit the switch and the wheels disappear! With a little planning, this process can be applied to any built-up wing with very little effort. Mechanical retracts have many virtues: they are easy to install, cost very little and operate reliably. Why not add that special touch to your next project!

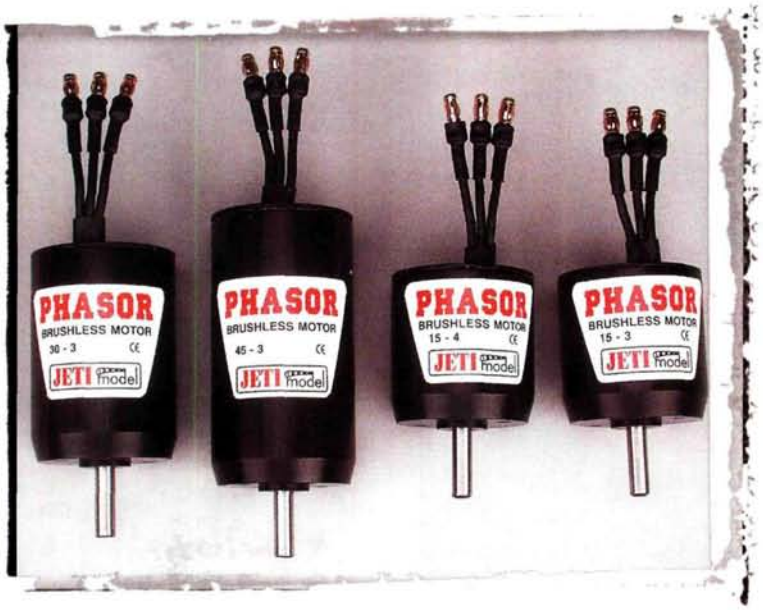
Hobbico; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.hobbico.com.*

Kyosho; *distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; (217) 398-6300; fax (217) 398-1104; www.kyosho.com.*

Affordable brushless power!

Jeti Phasor motors and sensorless controllers

by Bernard Cawley Jr.



For years, brushless motors and controllers have been acclaimed as being measurably more efficient and flexible in application than their brushed counterparts. They were also considerably more expensive than comparable, high-quality brushed motors. Not anymore; Jeti Model's introduction of its four sensorless, brushless Phasor motors, designed for use with its 30 and 40A speed controls, has changed all that. Let's take a closer look, first at the motors, then at their matching controllers and finally at the systems in use.

PHASOR MOTORS

All four Phasor motors are 1.4 inches in diameter—about the same size as a Speed 600 motor. Each has neodymium magnets and a hefty 5mm-diameter output shaft running in ball bearings. Phasors come with 1½-inch-long, installed power leads that end in 3.5mm gold bullet connectors; mating sockets are on the matching Jeti controllers. These motors have a relatively low kv, or voltage constant (rpm per input volt), and are primarily intended to swing fairly large diameter props on direct drive.

Phasors are best suited to sport, scale and aerobatic planes that are flown with varying power levels. They are not intended to provide short bursts of extremely high power such as that required by competition electric sailplanes. By swinging large-diameter props on direct drive, the Phasors can be used in place of a geared motor. The recommended rpm limit is fairly low, but this doesn't mean that they can't be used in reduction drives, as we'll see a bit later.

The smaller 15-3 and 15-4 units are approximately 1½ inches long and weigh less than 5 ounces. Jeti recommends a maximum continuous current of 35 amps on the 15-3 and 32 amps on the 15-4. At up to these current levels, the 15 Series would work well in applications where you might use a Speed 500, 600, AstroFlight 035 and 05, Graupner Mega, Ultra, or other motors commonly used on 6 to 8 cells. In particular, the 15-3 also works well in reduction drives on higher cell counts as long as the motor-shaft speed is kept within reason.

The 30-3 is almost exactly the same size and weight as a Speed 600, but it can easily handle twice the power and would work well in 8- to 14-cell applications where you might use a Model Electronics Turbo 10 on a high gear ratio or an AstroFlight 05 or 15. It could even be used in place of an Astro 25, one of the Aveox 1406 or 1409 Series motors, or a MaxCim D motor up to about 400W.

The largest member of the Phasor family is the 45-3. Jeti recommends it be run on 12 to 16 cells. It can be pushed to Astro 40 power levels or used in applications where a Mega S or a Graupner Ultra 930, the middle of the capability of an Aveox 1409 family motor, or either of the MaxCims at power levels of up to about 600 watts would be appropriate. In fact, you could probably push even more power through this motor if you used it with a controller of a different brand that can handle more than 16 cells. I have found that it works very well on only 10 cells, too.

All of these motors run very smoothly. As long as you stay within their stated current limits (see the specifications table) and provide airflow over the cases, they will get only warm to the touch—not hot; this indicates good efficiency.

SPECIFICATIONS

MOTOR: Phasor
TYPE: brushless
MANUFACTURER: Jeti
DISTRIBUTOR: Hobby Lobby Intl.
DIAMETER: 1.4 in. (36mm) diameter w/5mm diameter shaft; 3mm mounting holes on standard 25mm (1-in.) centers
LENGTH: 15-3 and 15-4—1.4 in. (37mm); 30-3—2 in. (52mm); 45-3—2.6 in. (67mm)
PRICE: $89 (15-3, 15-4); $99 (30-3); $149 (45-3)

	MAX RPM	MAX CURRENT (AMPS)	WEIGHT* (OUNCES)	KV (RPM PER VOLT)	NO. OF CELLS
Phasor 15-3	18,000	32	4.8	2,300	6 to 8
Phasor 15-4	18,000	35	4.8	1,800	6 to 8
Phasor 30-3	15,000	35	7.8	1,200	8 to 14
Phasor 45-3	15,000	35	10.7	800	10 to 16

*Weight with power leads and connectors.

JETI BRUSHLESS, SENSORLESS SPEED CONTROLS

The matching Jeti sensorless brushless controllers are only a little larger and heavier than many of today's brushed motor controllers with similar ratings. The 30A-continuous-rated JES 30-3P weighs 1.5 ounces ready to use. The 30-3P is rated for 6 to 10 cells and can drive up to four servos from the battery eliminator circuit (BEC).

The 40A-continuous-rated JES 40-3P is somewhat larger but weighs only 1.8 ounces with all wiring and connectors. It can handle up to 12 cells and four servos or up to five servos on fewer cells. An optocoupled version, the JES 40-3P Opto, works with up to 16 cells with no BEC and weighs 0.2 ounce less than the standard version because it doesn't have an on/off switch.

These ESCs have all the features you've come to expect from Jeti's microprocessor-based controls, including automatic self-matching of the throttle range to your transmitter and overheating protection. The low point of the range is established by the transmitter-stick position when you power up; the high point is set when you advance the throttle to full for the first time. The ESCs also beep to tell you when they are armed and ready to go: one beep for "brake on" mode and two beeps for "brake off" mode.

To switch the controller between brake modes, power up with the transmitter stick in the full throttle position and wait 5 seconds for the unit to beep four times. This toggles it from one mode to the other. Bringing the stick back to the off position then arms the controller as usual. It will remember the new brake mode until you go through this process again—it doesn't have to be reset every time you power up.

Because the controller handles the timing, reversing a motor's rotation is simple: just swap any two of the three wires running between the controller and the motor. The supplied 3.5mm gold bullet connectors make this extremely easy.

On the test stand, the Jeti brushless controllers operated very smoothly and easily started the Phasors every time. There is a burst of speed when the motor starts, and then it can settle to an "idle" of as low as approximately 700rpm. These controllers also run reasonably cool at part throttle. Providing space for air to circulate should prevent them from overheating as long as they are run at or below their stated rpm ratings.

Control response is very smooth. It is damped a bit but is not sluggish enough to be bothersome. The ESC also has a slight reverse exponential throttle curve. This makes more of the throttle stick's throw usable in the air. There are more than a couple of throttle-stick clicks between "full bore" and "I'm coming down now."

When the transmitter signal is lost, the ESCs shut down the motor cleanly after about a 1-second pause at approximately ½ power. When range-checking on the ground, I found that these controllers have little effect on radio range, even with the motor off or running at low speed (where I usually find the worst interference). This level of performance is outstanding.

The low-voltage cutoff in these controllers is set to cut the motor at 5.2 volts or 0.7 volt per cell, whichever is higher; I verified this on the test stand. This variable cutoff is kinder to packs with more than 7 cells than a fixed voltage cutoff would be. You can immediately rearm the motor to stretch your approach by bringing the throttle stick back to "off" and then advancing it again. Don't do this too many times, though, or you'll risk running out of radio power. By the way, Jeti's instructions caution: "When using economical class microservos, it is necessary to reduce the number of servos by one." In other words, if you use some of those fast, current-hungry 9- to 10g servos such as the GWS Naro HP BB, FMA S-90, Cirrus CS-21 and Balsa Products BP-105, use no more than three with the 30-3P and three to four with the 40-3P.

APPLICATIONS

In my Hobby Hangar electric Scout, I used the Phasor 15-4 with the 30-3P controller to replace a Velkom 24-12 ferrite motor and brushed controller. This is a 7-cell sport-cabin-plane relative of the better-known Puddlemaster or Pondside flying boat. With the same propeller—an APC 9x4.5 thin E-prop—the 15-4 gave me a boost of nearly 1,000rpm at full power, while decreasing the full-power current draw by 5 amps and saving more than 3 ounces to boot—a super tradeoff. With the Phasor and 3,000mAh cells, I got 15-minute flights of mixed aerobatics, cruising and easy touch-and-go's.

With that power system, I've also flown the Scout on some simple foam floats. It gets off the water in a hurry! At low speeds, the airplane is a bit squirrelly (too much rudder throw, I guess), and on

SPECIFICATIONS

ESC: JES
TYPE: sensorless, brushless
MANUFACTURER: Jeti
DISTRIBUTOR: Hobby Lobby Intl.
DIMENSIONS: 1.8x0.9x0.4 in. (30-3P); 2.3x1.2x0.4 in.(40-3P)
LEAD LENGTH: 2.7 in., motor; 2.5 in., battery; 11 in. receiver; 5 in. switch—except 40-3P Opto
PRICE: $73 (30-3P); $88 (40-3P); $88 (40-3P Opto)

	MAX CURRENT (AMPS)	WEIGHT* (OUNCES)	NO. OF CELLS	NO. OF SERVOS
Jeti 30-3P	30 continuous	1.2	6 to 10	Up to 4
Jeti 40-3P	40 continuous	1.8	up to 12	4 to 5
Jeti 40-3P Opto	40 continuous	1.6	up to 16	No BEC

*Ready-to-use weight.

floats, it's worse. Consequently, I have learned that a dunked Phasor motor and controller still work just fine once they've dried out. There is a bit of rust on the motor shaft just in front of the front bearing after three nose-down dunkings that left the motor submerged for perhaps 45 minutes total. I made no particular effort to dry it out each time, although I probably should have pulled the prop driver off and blown it dry.

In my trusty Sig Kadet LT-25, which is set up to use a 10-cell pack, I have used the 40-3P and 40-3P Opto controllers and the Phasor 45-3 to swing an APC 14x7 thin E-prop on direct drive! This combination turns about 6,500rpm at approximately 32 amps in the middle of the charge of a 3000mAh pack. Flight performance is sparkling, and without gearbox noise, this power is almost silent. Installation and setup are very simple, too. When the LT-25 is mounted on a lightweight set of Commander R/C floats, this power combo pulls it off water with no fuss at all. Great fun!

Lately, I've been flying the LT-25 with the Phasor 15-3 on a Modelair-Tech H-500 belt drive at a 3.6:1 ratio. I use this combination to swing the very same 14x7 prop on the same 10-cell packs. It gives me 6,200rpm at about 26 amps and is a bit lighter than the 45-3 as well. Even though it is bulkier, of the six I've used over the last three years, it is my favorite power system for this plane. I run the motor faster than both Jeti and Modelair-Tech recommend in this combination, but I have about 2½ hours of time on them so far without any signs of motor or belt distress. The belt drive has been used with another motor at similar pulley speeds for the better part of three seasons without a problem. Modelair-Tech sells combo setups of the belt drive, the Phasor motor and the controller for a good package price.

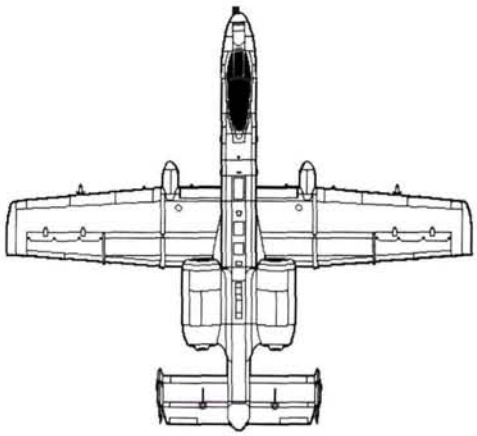
WRAP UP

Do we at last have brushless motors for the rest of us? For pilots of sport, scale and aerobatic 6- to 16-cell models, the answer given by the Jeti Phasors and their companion controllers is an emphatic "Yes!" The folks at Hobby Lobby tell me they are having a hard time keeping them in stock—and for good reason. For the electric flier, the Phasors and their controllers truly represent a leap in performance for the price. I highly recommend them.

APC Props; *distributed by Landing Products, 1222 Harter Ave., Woodland, CA 95776; (530) 661-0399; fax (530) 666-6661; www.apcprop.com.*

Hobby Lobby Intl., *5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948; www.hobby-lobby.com.*

Modelair-Tech, *P.O. Box 1467, Lake Grove, NY 11755-0867; (631) 981-0372; www.modelairtech.com.*



Wing structures and construction tips

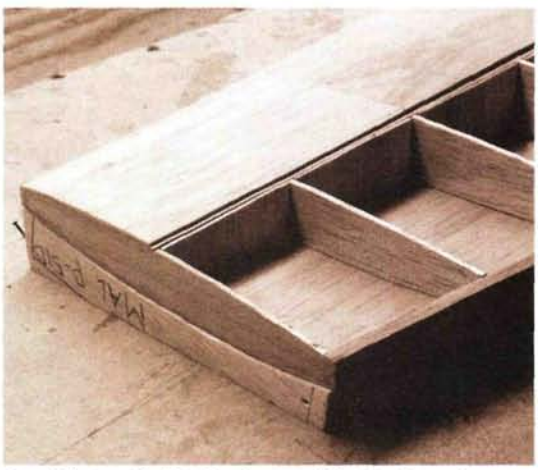
Everyone agrees that wings are a vital part of any airplane; most aircraft don't perform well without them! Compared with fuselage construction, for which a variety of construction methods can be used, there are far fewer ways to build a proper wing. A good wing structure should be able to withstand the forces that act on it during flight, but other features should be considered, too. The wing's span, average chord length and the model's intended airspeed all influence its design. It is also very important to keep the wing's weight to a sensible minimum. The main parts of a wing are its ribs, spars, and its leading and trailing edges, but the construction possibilities for these depend on the particular model. A fabric-covered, wire-braced biplane wing, for example, requires a much different construction method than does a fully sheeted cantilever wing of a WW II fighter, which might additionally be equipped with flaps and retractable landing gear. Let's take a closer look.

WW II aircraft such as this F4U Corsair have specific wing-structure requirements that must be accounted for when you build models of them. They have to be strong and be able to accommodate features such as retractable landing gear and flaps.

Wing construction for this fabric-covered Gloster Gladiator biplane differs greatly from that of WW II fighters. Being wire-braced, their wing structures can be built lighter and less ridged.

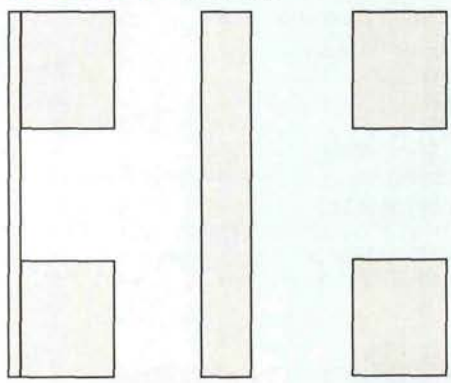
SPARS

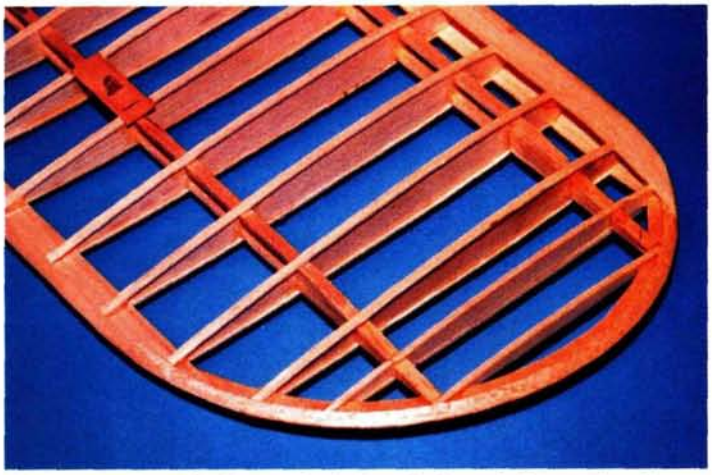
The spars are the basic foundation for each wing, and it is vital not to skimp on them. When you look at drawings of full-size wings, you'll notice that the main spar is positioned at the thickest point of the chord—generally, around 30 percent when measured back from the leading edge. This is done for a purpose. Regardless of the material used, it is much easier to bend something when it's lying flat than it is when it's standing upright. Plainly said, the thicker the wing section, the more difficult it will be to bend. Figure 1 shows various spar constructions with their relative moment values. To achieve the maximum bending resistance of the wing, it is important to properly connect the two spars with a shear web. A thin wing such as those commonly used on biplanes is often insufficient to allow the spars to be spaced far enough apart to produce a cantilever structure; this is why functional bracing is required. With a braced biplane, I usually omit the webbing to save some weight. From a stress-distribution point of view, it is better to brace a wing with flying wires. but aerodynamically, the biggest disadvantage of doing so is the enormous drag caused by this spider web. For smaller models—



By adding vertical-grain shear webbing to the main spar, you greatly increase its strength and resistance to bending loads.

FIGURE 1 **Spar design**





This Hawker Fury wing has a wingtip bow that's made from a three-layer sandwich of wood; its center is plywood with balsa glued to its top and bottom.

up to about a 60-inch span—I often install an auxiliary spar in the center of the ribs or make the main spar from very large balsa, onto which the ribs are then slid. This way, the wing gains sufficient strength, and the flying wires do not need to be functional. I usually make my spars out of basswood or spruce, although I have used hard balsa in the past. For highly loaded models, I add carbon fiber or Kevlar to the spars with some epoxy resin. This adds tremendous strength to the structure.

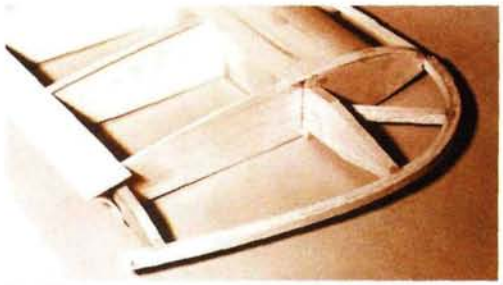
During normal flight, the upper and lower surfaces of a wing suffer from opposite forces; the upper side is pushed toward the center (compression), while the undersurfaces have to cope with a pulling force (tension); see Figure 2. To prevent the spars from breaking, a joiner web should be glued between the spars; this is generally made of vertical-grain, 1/16-inch balsa sheet, but very thin, 1/64-inch plywood can also be used. If everything is properly glued, adding shear webbing increases a wing's moment-against-bending strength by a factor of 24!

The wingspan also directly influences the spar's dimensions and the thickness of sheeting that's needed. The bigger the span, the more the structure's weight comes into play. As in every construction, however, it is best to avoid stress points. Figure 3 shows the difference between a full-size aircraft's tapered spar and an acceptable modeling spar structure. Tapering the spar out toward the wingtip ensures a good distribution of the flight loads.

Last but not least is the model's speed. It is easy to understand that slow-flying biplanes or light planes require lighter spars than do racers that have to endure higher wing loads. The bigger and faster the model, the larger and stronger its spar needs to be.

RIBS

Wing ribs serve mainly to give shape, and therefore, they do not need to be very strong. Their thickness, however, should be sufficient to allow proper gluing to the wing sheeting. The bending forces described earlier act almost completely on the spars and sheeting; the ribs are hardly affected. Ribs can usually be cut from soft 3/32- or 1/8-inch balsa sheet. Depending on the stiffness of the wing sheeting used, I keep a maximum distance of about 2 to 3 inches between each rib; this avoids the "starved horse" sheeting sag. With a one-piece wing, it is also a good idea to increase the thickness of the center section ribs that support the sheeting where it contacts the fuselage at the wing saddle. I use 1/4-inch balsa here.



For lightly built aircraft such as the Rollason Turbulent, wingtips can be made of strips of laminated balsa that have been glued and bent to shape before they are cut and fit into place.

LEADING AND TRAILING EDGES

Leading and trailing edges don't add much stiffness to the wing; they serve mainly to give shape to the airfoil section. There are several different ways to make leading edges, as shown in Figure 4. To make them more ding-proof, always use hard balsa. Trailing edges are a different matter, especially with scale models. One of

FIGURE 2
Load forces on a wing

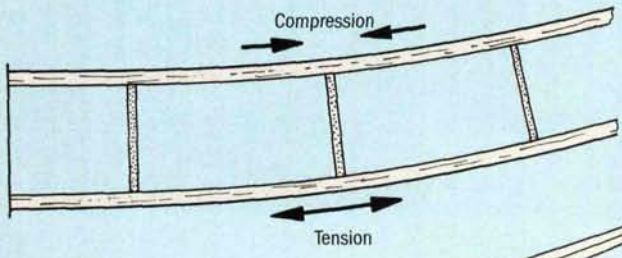
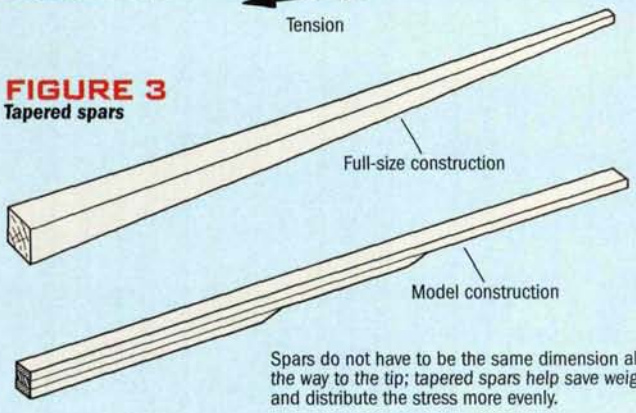
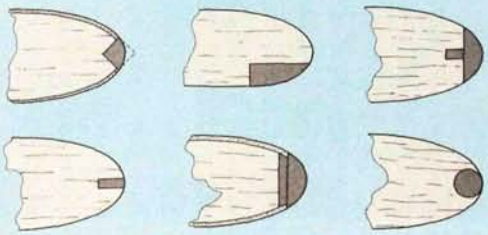


FIGURE 3
Tapered spars



Spars do not have to be the same dimension all the way to the tip; tapered spars help save weight and distribute the stress more evenly.

FIGURE 4
Leading-edge design



Leading edges carry less stress than the spars, so they don't have to be as strong; whichever way you make them, be sure to use hard balsa to make them more ding-proof.

FIGURE 5
Trailing-edge design

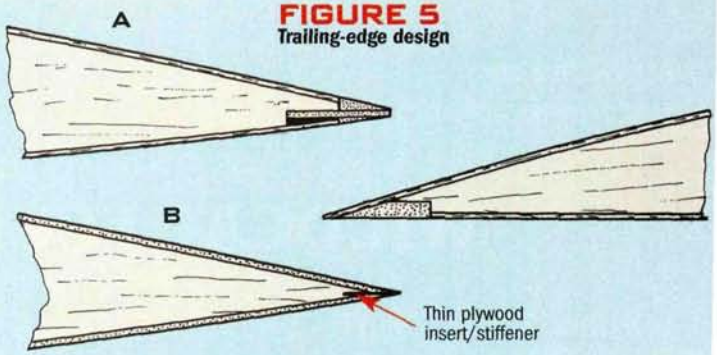


FIGURE 6
Vintage trailing edge

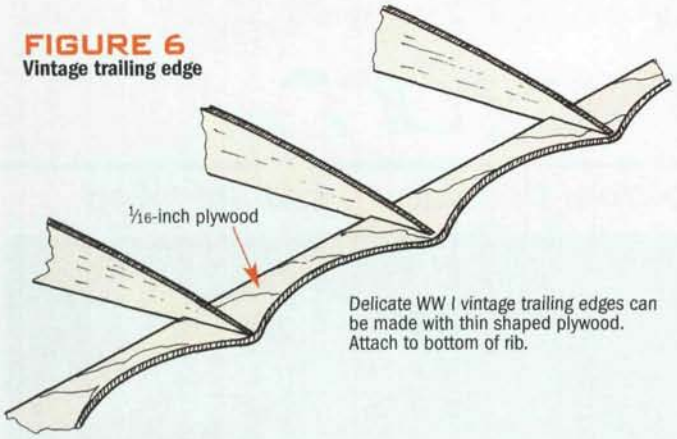


FIGURE 7
Center-section reinforcement

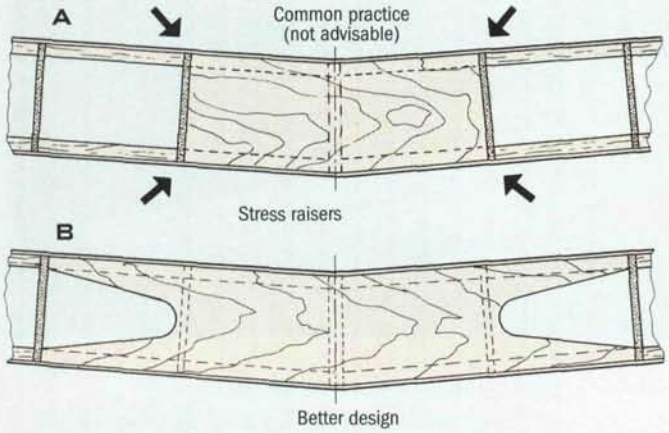


FIGURE 8
Sweptwing bracing

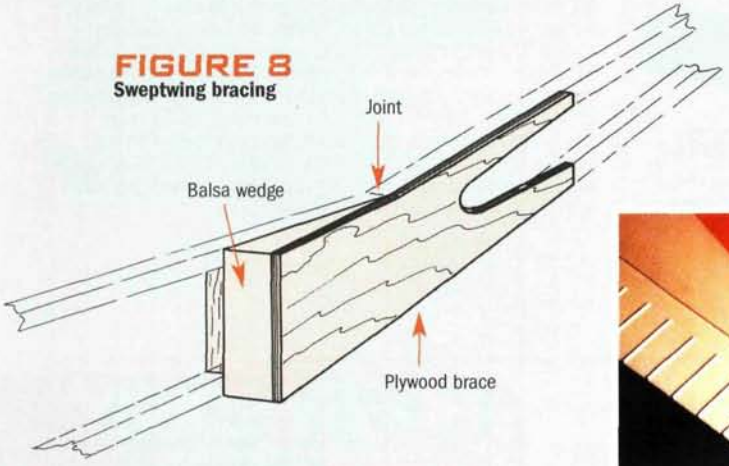
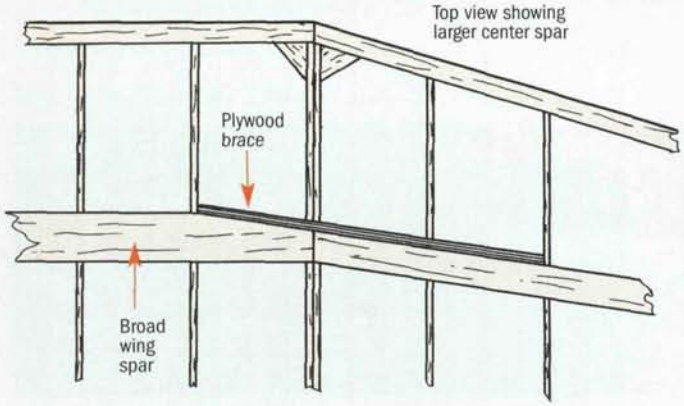
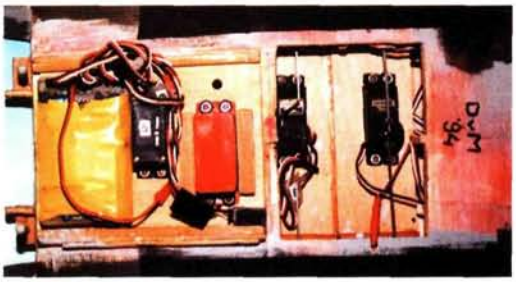


FIGURE 9
Tapered wing bracing



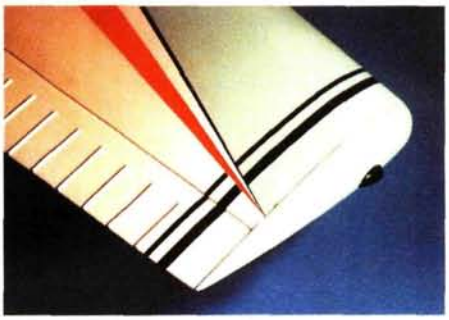


The wing center section is where the flight loads concentrate, so this area must be built to withstand the stresses. Plywood braces and thicker ribs help distribute the loads.

our goals is to make trailing edges a scale thickness—that is, as thin as possible—without sacrificing stiffness. Figure 5 shows some of the methods I've used. A common construction method is to insert thin plywood stiffeners and glue them to the rear sheeting using epoxy, as shown in Figure 5B. In more recent designs, I have also used thin carbon-fiber profiles to stiffen the trailing edges. The thin metal cable trailing edges that Anthony Fokker used on his famous early designs are of special interest. To avoid unnecessarily complicated model designs, it is best to duplicate these fragile structures with thin plywood and glue them to the bottom of the ribs as shown in Figure 6. When covered, this deviation is hardly noticeable.

WING CENTER SECTION

A major feature in a wing is its center section, at which point the two wing panels are connected. Flight stresses are concentrated in this area, and we need to add sufficient strength to deal with them. Figure 7A shows a common wing dihedral-brace design that is also guaranteed to increase stress and should be avoided. It is much better to extend the brace about two ribs out of the center, as shown in Figure 7B. Some designers use hard balsa sheet as material for these wing braces because they believe that the wing sheeting should be sufficiently strong to withstand flight stresses. For peace of mind, I always use ⅛-inch aircraft-grade plywood. The space between the two spars at the center section should also be filled with hard balsa. When dealing with sweptwings, such as many fighters, the spars do not line up parallel in the center section. Here, I fill the gap with a block of hard balsa (see Figure 8) or use a wide spar in the wing's center section (see Figure 9).



My Zlín Z-526 AS has formed fiberglass wingtips that cover its ailerons' hinge points.

WINGTIPS

Here as well, the builder has many choices. Straight and slightly curved tips can be made simply out of a solid balsa block. For more delicate designs, such as my Dennis Bryant-designed Hawker Fury, the wingtips consist of a 1/16-inch ply core with a layer of balsa added to each side. If I need to hide a hinge point (as on my Zlín Z-526 AS), I make the wingtips out of formed ABS plastic or molded fiberglass. Flat, curved wingtips, as on the Rollason Turbulent homebuilt, can be made from laminated strips of balsa and glued together to form the tip's shape.

These are just a few of the ways to deal with scale, built-up model wing structures; I certainly haven't mentioned them all. As always, if you want to scratch-build your own wing structures, learn from other designers; look at their plans for similar designs, and see how the experts do it. ✈

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I covered an indoor model with LiteFilm and began by cutting the material slightly larger than the surface I was covering. I removed the backing and placed the film over the first wing bottom. I tacked it into place at the root corners and then at the wingtip corners. I then tacked it to the main spar, and I sealed the leading and trailing edges while pulling the wrinkles out as I went. I did this for the other wing surfaces, and after both panels were covered top and bottom, I used the iron to shrink the material tight. All the minor wrinkles disappeared, and the wing looked great. More important, the film shrunk perfectly without warping or twisting the lightly built wing out of shape. In a couple of places where the film had stuck to the main spar, I used a piece of tape to "pop" the film off the underlying structure. When I applied heat to the dimpled area, it quickly shrunk tight.

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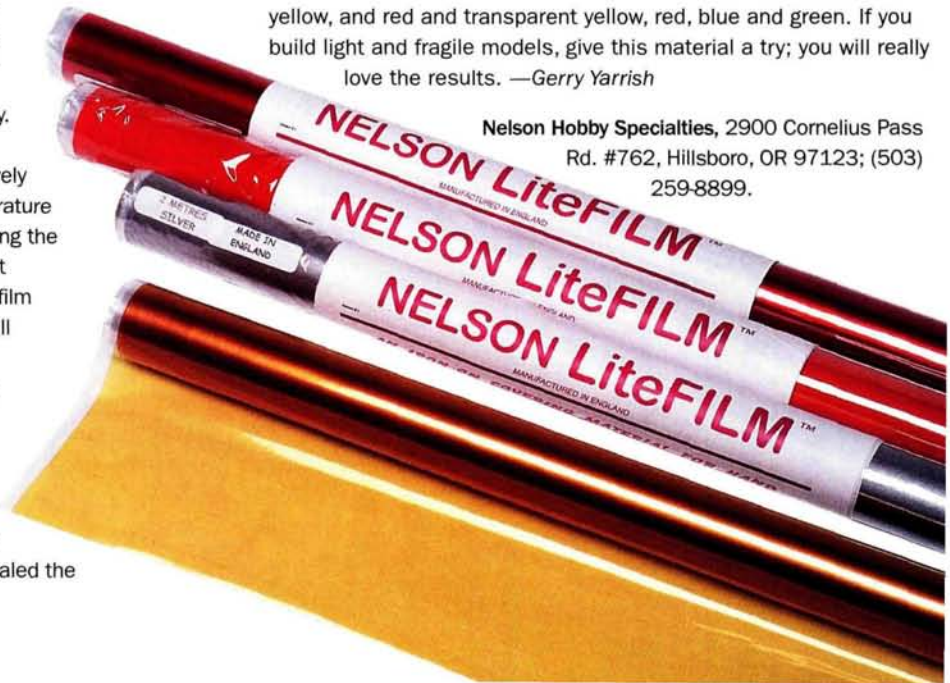

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Rack 'em up

One thing all modelers have in common is the need to store airplanes safely and out of the way. Just leaving them lying around the workshop is an invitation for hanger rash. Most modelers, myself included, pound some nails into an available wall and use a length of string around the tail to hang the fuselage on the wall. What about the wing? Unless your workshop has exposed rafters, or you build an elaborate rack system, the wing usually is stood on its wingtip leaning against a wall. Not good. Hangar 9 has an inexpensive solution to this dilemma: Airplane Storage Racks. These storage racks are made of solid hardwood and painted white. The prongs have foam guards that protect your airplanes from dings and scratches. Mounting the racks with the included heavy-duty wood screws is simple and takes just a few minutes. For safety, the racks should be mounted to wall studs. If they aren't, they may pull out of the wall, damaging the model and the wall. The fuselage rack accommodates a single fuselage, while the wing rack holds two wings. The racks are sold in separate sets for the fuselage and the wing and include mounting screws. The fuselage rack sells for $5.95 and the wing rack costs $9.95. These two storage racks are great workshop companions for your pride-and-joy airplane. *—Rick Bell*

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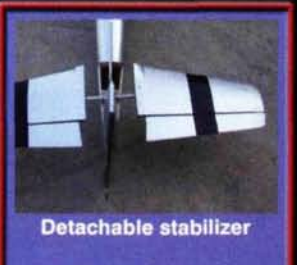

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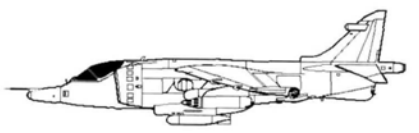

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BY BRUCE THARPE SR.

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Double Dynajet fun

SPECIFICATIONS

MODEL: Double Whammy
TYPE: sport jet
WINGSPAN: 62 in.
WING AREA: 836 sq. in.
LENGTH: 59 in.
WEIGHT: 10 lb.
WING LOADING: 27.6 oz./sq. ft.
POWER: two Dynajets
RADIO: Futaba 6DA
FUEL: methanol/nitro mix

There's nothing like the sound of a Dynajet. The thundering roar of 220 miniature explosions per second and the rush of super-hot pressure waves blasting from the tailpipe is enough to rattle your brain and send grown men for cover. Those who have heard it will tell you that it's a noise they will never forget. To say these engines are loud is a massive understatement—but it's a pleasant sort of loud. For pulse-jet lovers, perhaps the only music sweeter than the sound of a Dynajet is the sound of two Dynajets.

Pictured with their prized plane are primary builder/engine mechanic Bruce Tharpe Sr. (left) and designer/pilot Bruce Tharpe.

Left: a pulse-jet is a very simple engine; it's started with a spark plug, and the daisy-shaped reed valve is its only moving part. The exhaust tube is thin stainless steel. Assembled, this engine weighs about 1 pound.

Below left: a view through the wing saddle shows the clear plastic fuel-tank enclosure and the two bladder tanks. For safety, the Dynajet uses a servo-controlled shutoff.

That was confirmed last October for my father and me when our latest creation, the Double Whammy, took to the sky for the first time. This unusual jet features a very traditional structure of balsa, plywood and spruce, but its main features are the two Dynajets strapped to its fuselage. With each engine spewing nearly 5 pounds of thrust, the 10-pound Double Whammy certainly doesn't suffer from a lack of power. Even with its fixed landing gear, we estimate its level flight speed to be in the 130- to 150mph range.

During the past 20 years, we've built a variety of sport and scale models with pulse-jet engines mounted on top, underneath and inside. Our greatest progress, however, has been made with the fuel systems. Our first RC model used a Sullivan tank with a fixed pick-up. It flew well, but aerobatics were out of the question because a single air bubble would put out the fire. We now use a latex bladder tank to provide pressurized, bubble-free fuel to a Cline regulator. The bladder holds about 32 ounces of a methanol/nitromethane mix, which a Dynajet sucks up in about four minutes. The Double Whammy carries two of these bladders and is fully aerobatic.

Where do we fly such a beast?—not at our local field, that's for sure! Our most recent flight was at Black Rock, where the land-speed record was set a few years ago. A dry lake is ideal because there's no chance of starting a fire if the plane crashes. It also has the necessary room for the mandatory deadstick landings. Best of all, there are no neighbors to upset with the jets' mind-numbing roar.

I don't expect a surge of popularity for the Dynajet among RC modelers because it glows red-hot when running, doesn't have a throttle, can be temperamental and definitely makes a tremendous noise. But if you have the right place to fly one and can live with its limitations, the Dynajet can provide true jet power for models that will steal the show wherever they're flown. Especially if you use two of them!

A Double Whammy plan and spectacular flight footage are available. For more information, please feel free to contact me: 8622 E. Evans Creek Rd., Rogue River, OR 97537; (541) 582-1708; tharpe@cdsnet.net.

This photo of the Double Whammy was taken at Apex Dry Lake near Las Vegas, NV. The all-wood model is covered with MonoKote, and Bill Fulmer did the graphics. Aluminum protects the fuselage sides from the intense heat of the twin Dynajets.

Below: the world's largest gathering of RC pulse-jet models! With the exception of the twin-fin, low-wing model, which was built and flown by Richard Caine, the Tharpes built all of the aircraft shown here.